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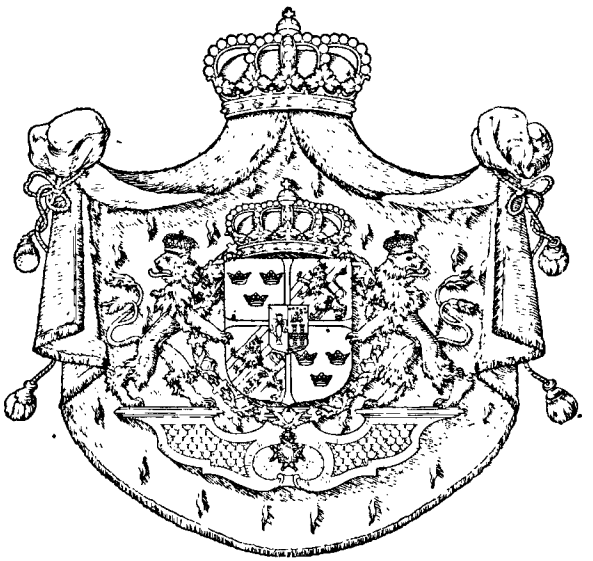

SWEDEN

SWEDEN

HISTORICAL AND STATISTICAL HANDBOOK

BY ORDER OF THE SWEDISH GOVERNMENT
EDITED BY

J. GUINCHARD

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SECOND EDITION
ENGLISH ISSUE

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1.

THE NATURAL RESOURCES OF SWEDEN.

The more investigation penetrates into questions respecting the conditions and possibilities of culture, so much the more does the connection between nature and culture manifest itself. Human knowledge and activity cannot, beyond a certain degree, overcome the difficulties placed in their way by nature. As culture advances, the distances between points on the earth's surface are of less importance, and as nations increasingly coalesce into one humanity, the irresistable divisions of labour among the various regions of the world emerge all the more clearly. Every region has its own special task in the economy of mankind, dictated by the natural resources which are to be found in it. In the presence of such a conception, and not least during the production of such a work as the present one, we are met by the question "What are, in an objective sense, the possibilities of Sweden, compared with those of other countries?" This enquiry shall receive a brief reply here, so far as is possible at the moment.

The natural resources at the disposal of a nation consist partly of mineral wealth, partly of the production of mechanical power. as well as of vegetable and animal products, which are conditioned by physical features, soil, and climate; and partly, perhaps not least, of the innate power of the people itself. which ultimately has its roots in the character of the race and the reaction which nature and climate exercise upon it during the lapse of centuries.

Sources of mechanical power.

We commence with the *sources of mechanical power*, inasmuch as these have proved themselves, in the development of modern culture, to be of such pre-eminent importance for the utilizing of all other resources. Setting aside for the moment the muscular strength of men and draught

animals, the supply of power, as is well known, is derived in our own times first and foremost from coal of diverse kinds, mineral oils, different vegetable substances, above all wood, and from waterfalls.

Mineral fuels. Nothing during a thousand years has altered the conditions of human life to such a degree as the use of mineral fuels, which began to be used, in an increasing degree as the latter half of the 18th century. Thanks to this, it has now become possible in a short time to transform into productive energy untold supplies of power, which have been stored up during endless ages of the world's past history. And it is the inhabitants of the great coal countries which have in our own days taken the lead both in intellectual and material progress. Sweden has been compelled to utilize considerable portions of her products in the purchase, from lands, more happily situated in this respect, of coal for her rapidly growing industries. For instance, in the beginning of the decade 1890, 90 kilogrammes per inhabitant were imported, 812 kg. in 1910, and 765 kg. in 1912. Cannot this be changed?

On this point we have, in the first place, two natural resources to consider: the *occurrence of coal* in Skåne, and the *peat-mosses* distributed over the whole country; but also possibly, in the tracts of Västergötland among others, *mineral-oils*, and the *wood-spirit* which can be obtained from the deciduous products of our forests.

Coal. The district in North-West Skåne which is coal-bearing has a probable extension of about 800 square kilometers, with a coal supply of certainly 106, conceivably about 300 millions of tons, that is to say, enough for a few decades to supply Sweden's present needs. The comparatively low proportion of best quality coal in the strata makes it, nevertheless, impossible to produce it economically, without at the same time extracting lower qualities of coal, and the valuable fire-proof clays which occur with it. The problem, therefore, that has presented itself and still continues to do so, is how to discover a satisfactorily extensive use for these products. By, e. g. creating an increased export for the products of the clay industries, or by the utilization of inferior qualities of coal in the production of iron, or by generating electric power it is possible to increase the production beyond the somewhat more than 300 000 tons which has been the result of the last few years. If one can succeed in maintaining the home production of coal at about $^1/_{15}$ to $^1/_{20}$ of the total consumption, which has been the case of late years, one ought to be fairly satisfied. This, however, is so small a fraction of our needs, that the question arises whether no possibility can be found of bettering this state of affairs.

Peat. It is anything but easy to estimate the value of the peat-mosses for the next few decades; and for a longer period it is of no purpose to make any calculation. We are aware that extensive peat-moss areas exist over the greater part of the country, but the main question, touching the economic worth of this source of power, involves to quite as large a degree two other factors. One is the extraordinary tena-

city with which peat substances hold water, the result of which is that a great amount of energy is required to dry the peat; this of course entails considerable outlay in a country where the summers are usually short and very rainy. The other condition which so largely prevents the utility of peat as fuel is the proportionately small and thin layers in which it occurs, even in the greatest and, to a large extent, the majority of the moss beds. When one reflects that, even in good and prepared peat-fuel, the amount of energy averages barely half that of coal, while the ash refuse is considerably higher as a rule, it may readily be inferred that the "peat question" does not come into the category of easily solved problems. On the whole, it is beyond dispute that the question is unsolved as yet, and one cannot reckon with any certainty in the near future on peat as a source of power, in any other sense than that those industries which are favourably located near peat-mosses suitable for fuel may be expected to extract from it, more or less advantageously, a considerable proportion of their necessary power. Apparently it will be a long time before any appreciable portion of the country's requirements in this respect will be met by such means. On the other hand, the importance of peat-moss beds as cultivable soil are probably comparatively greater, but this is not our present subject.

Shale-oils. Another mineral fuel may possibly come into use in the future, viz.. the oils which are incontestably to be found in the Silurian shales of Västergötland and other provinces. At present the question of working these to such a purpose is in the initial stages, but it has been taken in hand, and the remarkable success achieved in utilizing such fuel in Scotland and France appears to open up the probability of success in Sweden too. In that case a considerable proportion of the demand for motor oils etc., can be met. The Silurian shales which are combustile (1 500—2 600 calories) contain as much as 6—8 % of oils and a considerable quantity of sulphur (6—9 %). The latter could also be worked up into valuable artificial fertilizers.

Water-power. The greatest and most important store of energy in Sweden manifestly consists of its waterfalls. Through the abundance of water-courses, through the multitude of terraced falls, through the numerous lakes whose waters are capable of regulation, and through abundant discharges, the country should be one of the best endowed in the world in point of water-power. The remote situation of a large proportion of its great falls, the long winter in the districts where certain of these are located, and the small height of many falls are circumstances which in certain cases reduce their value. It is to be observed that about 3·5 million horse-power can possibly be utilized in the next few decades. Of this estimated total about 850 000 horse-power will probably have been harnessed by 1915. At the present moment, waterfalls produce more than half of all the mechanical power in the country, a fact which clearly illustrates their enormus importance for the entire economic life of Sweden.

If an estimate is made of the position of Sweden as a producer of energy, it will be found that the country possesses very considerable sources of power, even if a considerable direct export to other countries cannot be considered possible. If development advances on the same lines as hitherto, part of the power required must be constantly purchased from abroad; and therefore a quota must be defrayed out of that revenue which other natural advantages are able to provide. The country, nevertheless, is, as we have shown above, more favoured in this respect than a large number of other countries.

Mineral wealth.

Ores. The mountainous regions of Sweden contain in no few places larger or smaller deposits of ore. Of these, nevertheless, from the point of view of present industrialism, only the *iron ores* are of any considerable importance; but, in compensation, these belong to the greatest and most productive in the world. They are concentrated in two comparatively small districts: the one, known from ancient days, is in Bergslagen, in Central Sweden, stretching from Värmland in the south-west to Uppland in the east, embracing about 15 000 square kilometers, and containing nearly a tenth part of the country's supply of iron ore; and the new mining district, that in northernmost Lappland, containing the remaining nine-tenths. Outside of these tracts few ores are found, and they are generally of less value.

An attempt has lately been made to arrive at an estimate of the supply of the world's iron ore. The result of this has been to establish the fact that the definitely known resources amount to possibly 22 400 million tons, containing in round figures about 10 000 million tons of iron. And yet, to this must be added probably several times this quantity of other deposits less well known. Meanwhile, at the present rate of consumption, the supply just named (and it is obviously this we have most nearly to reckon with) will be exhausted in about 170 years. It is on the basis which these figures supply that the resources of Swedish iron ore must be considered. Yet one other fact must be kept well in mind. The present extraction of iron at an economic advantage in any notable degree, can very seldom deal with ores containing a percentage of iron lower than 30 %. A yield of from 30—60 % is commonly reckoned as low, while a yield of over 60 % is considered as high. Of the present available supply of ore in Europe (about 12 000 millions of tons yielding possibly 4 730 millions of tons of iron) not more than about a tenth part, or 1 200 millions of tons, consists of high-grade ore. Of this Sweden possesses 1 100 million tons (92 %), and Russia the rest. The amount of high-grade ore in Sweden is much greater than the figures quoted above indicate, if the deeper-lying ore-deposits are taken into account. Thus, Kiruna-

vara has 740 mill. tons down to 300 meters, but magnetic investigation gives 1 370 mill. tons down to 1 500 meters. Since, then, a large quantity of the iron extracted abroad is extracted from a mixture of high- and low-grade ores, it is readily seen how great a value the extensive iron ore deposits of the country possess. Whether, therefore, the ores are refined at home or not, one of the most important and easiest realizable resources of nature, for a country rather cramped for lack of capital as Sweden is at present, lies in its iron ores.

The remaining ores, on the contrary, are to a large extent of less value although some of them do not lack significance from a private economic point of view. The mine at Falun represented one of the richest *copper* deposits in the world, from which riches, considerable for Swedish conditions, streamed for centuries; these have been computed by various investigators at a value of 600—1 000 millions of kronor; it is now worked out, like numerous minor deposits. The same thing has taken place with the wealth of the mines which produced *silver* together with lead. The case is somewhat better with the *zinc-ore deposits*, of which the largest, Åmmeberg, yields ore to the value of about 2 million kronor per annum. What value the *radium* (from the Silurian shales previously mentioned) may prove itself to possess is as yet impossible to decide. No discoveries of *precious metals* worth mining have been made in Sweden.

The ancient ore-country of the North thus proves itself to be an iron-country with some few very large fields of immense value, by no means an Eldorado, but a country where courage, foresight, and capital can extract considerable wealth from the bowels of the mountains.

Stone and clay. The ancient mountains of Sweden contain great quantities of hard and beautiful stone, which, thanks to the fact that builders of modern times have attained to greater power over their materials, can be widely used in building operations where strength and durability go before cheapness. Stone for the erection of monuments of various kinds, as well as for the paving of streets, etc., is today transported round the globe, if only the claims as to solidarity and taste can be satisfied. Yet there are few countries that can rival Sweden's granites in satisfying different tastes, and none surely are more favourably situated with respect to the facilities of export direct from harbour. The supply is sufficient not alone for the country itself, but also for the rest of the world for an infinite future. Sweden, therefore, has an undeniable natural advantage over the majority of her rivals in the markets, a fact which has been proved by developments.

In 1844 were founded the first granite quarries at Malmön near Lysekil. Hardly seventy years have elapsed since then: now in numerous spots in Bohuslän and Blekinge, and on the coast of the län of Kalmar, and in the interior of Götaland, granite and similar kinds of stone are being quarried. In 1912, the exports from these places amounted in value to 13·5 millions of kronor.

We must add to these figures the value of the rather considerable consumption of the country itself, which, nevertheless, is supplied to an appreciable extent by *brick* first and foremost, but also by softer and cheaper sorts of stone, such as *limestone* and *sandstone*. With reference to these building materials, Sweden is, compared to other countries, not especially favoured, if some exceptions are made for sorts such as the beautiful green marble from Kolmården, and facing tiles. These cheaper stones are of great value for the country itself. The limestone quarries in Skåne, Västergötland, Gottland, etc., even now annually produce materials for the building-industries, agriculture etc., up to about 3 millions of kronor in value, besides which the brick industry may be said to have an output of 16 millions of kronor. Good materials for the home *manufacture of cement* — consisting of both clay and chalk — are also to be found in many parts. Since 1873, when the first manufactory was started at Lomma in Skåne, the cement industry, too, has fought its way brilliantly forward among the industries of the country, and has, in spite of the fact that it has no greater natural advantages here than in neighbouring countries, obtained a hold as an export industry; in 1912, the export of cement was 3·4 millions of kronor. And hand in hand with it, in this particular, those industries advance which utilize the *fire proof clays* aforementioned from the coal formations of Skåne, and from *kaolin* strata in North-West Skåne, which are certainly distinctly valuable.

Rocks and certain sedimentary deposits yield not only building materials; they also contribute in every decade an increasingly large quota to the trade of the world in *nutritive salts for vegetation and animal life*, and raw materials for a flourishing *chemical industry*. For centuries Sweden has been paying out to the countries that produce common salt, and from the commencement of the eighties to Germany for potash salts. The country has even gone to Chili and other lands for nitrogen salts. Does Sweden, then, lack all these articles which are necessary for modern agriculture?

Lime, that great magician in its power to increase the fertility of the soil, is found within certain districts to an inexhaustible extent, but as it unfortunately occurs in very slight quantities in most parts of Sweden, it is now, and is destined to remain, one of the most exacting tasks of Swedish agriculturists to effect its transport from the tracts which bear lime to those that lack it. The value of the lime distributed over the country for agricultural purposes is already reckoned in millions, and it is a happy thing that such abundant resources of it are to be found. If nature herself had distributed lime all over the country, as she has done in certain other lands, the course of the history of Sweden might have been different and yet more magnificient than it has been.

Our rocks and soils possess an inexhaustible supply of another important means of nutrition for vegetation, in *potassium;* but this is in a chemical

form not very accessible for plants. New discoveries and new methods in recent times seem, however, to render possible its utilization. If this result were attained, a great source of wealth would be open up for Sweden; yet no one can foresee the result with certainty.

Nitrogen can certainly not be extracted from the earth, but with the aid of the electric energy generated by water-power it is now taken from the atmosphere and combined with the country's abundant supply of lime.

Here and there in the rocks of Sweden other valuable deposits of different kinds are also to be found. We have been able to indicate above only the largest and most important.

Generally speaking, it can nevertheless be said that Sweden is by no means poorly endowed. The absence of gold has certainly been detrimental to economic development. The mobile capital which even moderate resources of this kind directly bestow upon a country, and which supports and stimulates enterprise in various spheres has not been easily obtainable in Sweden, but has had to be won by laborious effort. Meanwhile, (especially in the matter of the really superior natural resources — iron-ores and granites) the problem may be said to have emerged from the preliminary difficulties, and abundant possibilities of development very certainly loom in a not very remote future.

Conditions and possibilities of production in the Vegetable Kingdom.

Among the natural conditions which in any country govern the cultivation of useful commodities from the vegetable kingdom, the *original composition of the soil,* on the one hand, and the *climate,* on the other, must be considered before anything else.

Over a large portion of Sweden the soil consists of difficultly cultivated moraine soil, unsuitable peat-mosses, or rocky soil useless for cultivation. Only within certain boundaries, pre-eminently the stretches of coast-land, wellsituated from the point of view of communications, has man been, so to speak, invited to settle down as a farmer. By far the greater part of the country has had to be left under timber.

But certain parts, the plains of Skåne (intended by nature to be the finest agricultural soil bestowed upon this continent), as well as other districts of the country where rocks with strata rich in lime have originated a soil remarkably well adapted to cultivation. In these places, too, the old, wealthy tracts are to be found. Unfortunately, however, the area of these districts is but 8—9 % of the entire country. The soil in the remaining parts of the country is poor on the whole, when we consider the amount of nutrition cultivated plants require, if they are to be brought to produce rich crops. The fact is also proved by the small proportion of the country, which has been laid under the plough, viz., about 10 % of the 35·2 millions of hectares, which are situated below the forest limit.

This circumstance is also affected by the fact that all cultivable land has not been brought under operation. Obviously no doubt can be entertained that the acreage will gradually become more widely extended. During the 44 years, 1865—1909, it has been increased by about 1·3 millions of hectares, or nearly 36 %, but no great extension of cultivation must be expected in the future, partly on account of the lack of really suitable soil, partly because the land is often better adapted to forestry, which, when a rational system of forestry has made its influence felt, is more profitable, under the constantly increasing price of timber, than farming poor ground that is expensive to cultivate.

The other important factor of production is *climate*. It is incontestable that Sweden, considering its northerly position, is wonderfully favoured in point of climate; its temperature in January is 12 to 13 degrees higher than the mean temperature of other countries in corresponding latitudes. It is this happy circumstance that endows the country (in spite of its geographical situation compared with South Greenland, the lands round Hudson Bay, etc) with the possibility of winning a place among those nations that are in the van of human culture.

But the life-giving warmth of the South is lacking. Most of the cultivated species in Sweden have to be grown in the neighbourhood of latitudes further north than which they cannot exist. The feeble sunshine of the North allows of only a comparatively short vegetative period; night-frosts are frequent. On the whole it may be said that the farther north the greater the cost of production of the crop from cultivated plants. It is therefore no marvel that agriculture is difficult, in rivalry with countries that possess a more beneficent sunshine, nor that specific precautions have had to be adopted at times e. g., duties on cereals, in order to distribute over a longer period the effect of the disadvantages that competition in the markets of the world has brought with it.

The *vegetable foods* cultivated in the country produce on the whole, carbon hydrates (pre-eminently starch, as in cereals and potatoes, or, in the most favourable instances, sugar, in the form of beet), while the more valuable fatty substances are produced in a roundabout way through cattle. It is chiefly in warmer climates that vegetables can be profitably cultivated to generate fatty matter directly. Slowly but surely vegetable fat is pushing its way into household economy. This may eventually threaten the output of butter; but pasturage, one of Sweden's most valuable resources, has by no means on that account sunk in value, but advances more and more in usefulness than heretofore though it will be utilized in other ways. The *production of meat,* so far as can be judged, will in future times be of more importance for the country than it is now. Here is most surely a most favourable line of development for Sweden, for with reference to the extension and quality of the pasturage, the country stands undeniably in the forefront. There is a need, nevertheless, that more productive and improved kinds should be cultivated from the prevailing

species of natural grasses. With the great increase in density of population of the great grainproducing countries, and their much greater immediate consumption, the stern rivalry between countries, in point of cereal production, seems likely to get equalised, and most certainly with definite advantages to Swedish agriculture.

In the cultivation of *fruit-trees,* whose products have attained a much wider use in the household, with increasing prosperity, and to a manifestly higher degree than in the case of agricultural products, it is true that Sweden enjoys no specially favoured position. These come to an overwhelming extent from warmer climes, but not a few of them can be reared in Sweden with financial success, though with difficulty. It is undeniable that, as yet, those possibilities have not been quite exhausted, which exist in some parts of South Sweden especially, and that is the only part of the country which can come under consideration here.

The soil and climate of Sweden, therefore, as regards farming, are to be reckoned in the category of countries by no means especially favoured, but are to be classed with those that possess such passable advantages as will enable an industrious population to face with calmness the changes of the future.

However, the prospects of *forestry* look brighter and more hopeful than in other countries, if it is possible to direct it prudently. Half of the soil of Sweden is covered with forests; though barren as farmland, the soil is well-adapted, on the whole, as timber-land. The climate is excellent for sylviculture in the South and Middle of Sweden, satisfactory in the southern and central regions of Norrland, but evidently less satisfactory in its northern regions. For centuries enormous capital has been derived from virgin forests, both for home use and for sale; during the 40 years 1871—1910, statistics of exports abroad show a sale of timber and other products of forestry amounting to 5 340 millions of kronor, an immense amount for a country of which the total national wealth in 1908 was computed at 14 000 millions. During this period the great virgin forests of Norrland were opened up, and very large portions were brought into the market from the treasures stored by nature during the last 300 years or so. But no error will have been made, and no risk taken, if only a few of the millions that have been derived from the forests are sunk there again. For it is beyond argument that the forest-land in Sweden, with the conditions secured by nature, can, with reasonably care, produce far more than virgin forests have done. Meanwhile a brighter prospect is already dawning, and the coming generations will experience in fullest measure the truth of the adage: — "the future of Sweden lies in her forests". If properly nursed, they can at some future time bestow on the country and her industries a powerful financial position in the world, far more certainly than any other of her natural resources.

Even centuries ago an incalculably great change for the better began to make itself felt in the position of Sweden, when the countries of Central

and Western Europe began to be so thickly populated and so de-forested, that the neighbouring peoples, first those of the Hanse towns, then the Dutch, and later the English had to turn to Scandinavia for timber. Thanks to favourable conditions of nature, the position has, since then, become that Sweden is indisputably one of the greatest timber exporting countries in the world. New regions have been opened up, fresh virgin forests elsewhere exploited, but Sweden consistently maintains its premier position amongst those countries that deal in timber, thanks to the excellent quality of its products and its excellent highways of transport along its rivers and other water-ways. Iron, steel, and cement have had a triumphant progress through the world, but still the demand for the products of the forest is as urgent as ever from the great countries, with their ever-increasing populations. The immense forest tracts of the West will soon have nothing to offer the markets outside America, the countries to the East will soon have exhausted those of their virgin forests that are easily accessible, and the great supplies of timber from the virgin forests of Siberia can scarcely be put on the market at prices unfavourable for the Swedish industry, on account of the immense distances and the consequent great cost of transport. The development of technical science has carried us from round timber to sawn, and on to woodpulp; we can scarcely make a mistake in prophesying that organic chemistry, will, before long, advance to methods to of using now worthless products of the timber industry which will very considerably enhance the value of the forests of Sweden. When, in a not too distant future, the virgin forests have everywhere been transformed into timber, then will come the halcyon days of Sweden's forests, provided that, by then, they have been set in order; provided that the State, the communities, and private persons have sunk all that is possible of the necessary capital required to secure permanent improvements.

Nature has presented Sweden with no source of wealth to be compared with what lies slumbering in the depths of the forests!

The animal world and its economic production.

We might say that the age of the chase is gone by, and that of fishery has commenced, when we consider the products bestowed upon Sweden for her national economy by the animal world and the seas that surround her shores.

Even though the value of *game* may be reckoned by millions of kronor, yet the plough and the axe have so far disturbed the seclusion of the larger beasts and checked their propagation, that their flesh, and above all their skins, which at one time were among the most importants items of export, can scarcely be of any real importance again.

Possibly the great areas of peat-land and forest may once more provide a quiet retreat for the *breeding of furred animals*, with the beasts in a kind of half-wild condition. The indications in America afford good hopes for

the time to come. If these hopes are fulfilled, few European countries will possess such excellent natural conditions as Sweden does for creating such an industry.

Another future industry, for which South Sweden especially has very great advantages, is the production of *fresh water fish* on a large scale. Owing to an increasing demand from a growing number of consumers, created by a raised standard of living, fish will find an increasingly large market. The forward march of fish cultivation, rationally ordered, is long and difficult, but promising.

The development of *the Swedish west-coast fisheries* have proved that purposeful energy can deal with those riches of nature, whose existence has long been doubted. In 1860 they yielded only a little over half a million kronor, but now they produce about 8·5 mill. kr. Natural resources existed then as now; the difference is that methods have been found and used to find them in the proper places, out in the open sea, and to take possession of them there. The whole coasts of Bohuslän and North Halland, thanks to the growing utilization of this source of wealth, have been exalted to a prosperity scarcely dreamed of before.

Brief reference has previously been made to the breeding of *domestic animals.* On the credit side are to be placed relatively good pasturage; on the debit side, a long winter with indoor feeding. When the old native strains, tough and hardly, but for centuries scantily fed, have been improved, and the good qualities of suitable new breeds have been thoroughly crossed into them, a very respectable place in cattle-breeding will be taken by, at any rate, South Sweden.

The vigour of the Swedish Race.

Whoever will estimate the material influence of Nature on Man, in the case of Sweden, must not overlook the effect of the former on the Swedish race.

It has with some truth been remarked that Sweden is not a very rich country, and, in coming from the favoured climes of Western Europe, one is struck by the contrast between, on the one hand, their wide cultivated stretches and the great industrial districts created by the coal and iron there, and, on the other, the hilly and thinly populated forest-land of the North.

Yet culture has not anywhere waxed higher than in Sweden, and few people in the world live better than the Swedish. How is that possible? Only one answer can be given. The people established here for some thousands of years, has to live under conditions which have favoured its development into a race attaining a high standard both materially and intellectually. This testimony is completely proved to be true out in America, where the Scandinavian race tends to fight its way into the

forefront in every domain, in the intense rivalry among representatives of all the civilized races of the earth.

The Swedes are quite disposed to criticise their own nation severely, and to show how, in material achievements, it has not attained to such a height as, e. g., the Germans, the French, or the English. The comparison is misleading; place a corresponding number of any of these in a land with the natural resources of Sweden, and the result will in all probability be no better than that which has been obtained in Sweden. Never in the days known to history has this land attracted the migratoring peoples. The only race so far as is known, that ever betook itself to Sweden in any number, from a still poorer land, was the Finns, in beginning of the 17th century.

It may, therefore, be briefly asserted that the Swedish people have ably administered that land in which they first settled, and that they have adopted themselves unusually well to the conditions of nature.

Taking one step further, and enquiring how natural conditions mirror themselves in the people's vigour one easily quits the sure ground of science and swings out into the broad, but insecure, realms of fancy. The deepest psychology of mankind is so involved, that the reaction of nature on it has hitherto escaped real scientific analysis. The only thing gained is conjecture rather than knowledge.

The immense forests where villages have nestled, as in a hole hewn out of them, and remote from each other, have indelibly stamped the Swedish character. Many of its weaknesses, where the question is one of economic rivalry, are perhaps a reflection of the solitary contemplative life of the forest-dweller; but so are also, possibly, some of its best qualities, the strong, calm acuteness of the leading sons of Sweden. The climate, with its cool summers and not too cold winters, has conceivably been among the most important of those natural factors which, during centuries, have built up the race, physically and intellectually sound, which now occupies Sweden; and this — perhaps with greater justice than the Swedes themselves are ready to acknowledge — is not infrequently pointed to by foreigners as the country's greatest natural wealth.

II.

INDUSTRIES OF SWEDEN.

A GENERAL SURVEY.

Sweden is one of the larger European countries, extending mainly from North to South. The consequence of this conformation of the land is that greater divergences are contained within it than within most other countries. Between the fertile plains of Skåne and the mountains of Lappland the contrast is enormous, the extremes, however, being linked together by multifarious transitions in climate and soil in the intervening provinces. With her manifold and varied possibilities Sweden, so to speak, forms a world apart. In configuration Sweden is one continuous body of land, two-thirds bounded by seas, which, however, are mainly inland seas. In the interior there are many large pieces of water with outlets that form either navigable rivers, or streams with falls and rapids. Out of the 44 786 448 hectares which constitute the total area of the country, no less than 3 685 255 are water, leaving 41 101 193 hectares as the actual land area.[1] The following Table 1 will show what portion of this area is cultivable, what uncultivable, and the proportion between the different kinds of cultivation.

After this preliminary survey of the country as the arena of the various activities of its inhabitants in pursuit of a livelihood, we shall proceed to adduce a few data as to the inhabitants themselves, grouped according to the chief occupations from which they derive their subsistence. Table 2 classifies the Swedish people into leading groups, ranged according to occupations, at different periods during the last few decades.

These two tables, of *Land* and of *People*, afford a kind of bird's eye view of the industries and occupations of the people, as they now are, as they have been in the past, and as they are tending to become. They

[1] Cf. Part I, Table 1 with more recent figures.

TABLE 1. *Distribution of Swedish Soil.*

Parts of the country[1]	Total area of *land* Hectares	Thereof, in hectares			Area in percentage		
		Arable land and natural meadow	Forest land	Other land	Field and meadow	Forest land	Other land
Skåne	**1 095 124**	650 861	292 735	151 528	59·4	26·7	13·9
Småland	**3 048 551**	662 065	1 479 410	907 076	21·7	48·5	29·8
Rest of Götaland . .	**4 540 147**	1 398 044	2 109 662	1 032 441	30·8	46·5	22·7
East Svealand . . .	**3 358 572**	936 714	1 970 303	451 555	27·9	58·7	13·4
West Svealand . . .	**4 569 983**	449 979	3 435 125	684 879	9·8	75·2	15·0
South Norrland . . .	**8 995 363**	408 152	6 428 856	2 158 355	4·5	71·5	24·0
North Norrland . . .	**15 493 453**	491 562	5 674 086	9 327 805	3·2	36·6	60·2
The whole country 1910	**41 101 193**	**4 997 377**	**21 390 177**	**14 713 639**	**12·2**	**52·0**	**35·8**

present in bold outlines a picture of the present industrial life of the Swedish people.

It will be noted that **Agriculture** is the staple industry of Sweden, the "mother industry",[2] as has been its honorable appellation from olden times. It is true that only 12 % of the soil is given up to tillage and meadows, whereas the average figure in Western Europe is 44 %. But the vast extent of Sweden in proportion to its population must be borne in mind. Sweden has 1 hectare of cultivated soil or meadow to every inhabitant, whereas Western Europe has on an average not quite $^2/_3$ hectare. These figures show painly that agriculture plays a more important part in the industrial life of Sweden than in most other countries of Western Europe. But we also learn from Table 2 that agriculture is rapidly decreasing in importance in Sweden too. Not merely relatively, but also absolutely, it employs and supports a considerably smaller number of people than it did forty years ago, in spite of the pretty large increase of population during that time. The *relative* decrease shows that industry and trade have now developed into leading occupations alongside of agriculture, which formerly dominated the field. The *absolute* decrease in the numbers of the agriculture population points to changes which have taken place within agriculture itself. Machinery has pushed its way into the service of agriculture in Sweden, superseding human labour, which tends to become more and more expensive, and conducing to impart to agriculture itself a more and more industrial character. The results of this transformation also appear in the magnificent development of dairyfarming, and, in Skåne, in the cultivation of the sugar-beet, for a sugar industry on a scale of great magnitude. Agriculture has thus, both in its methods and in its products, been carried along in the triumphal march of industrialism which is now passing through the world. And it evidently tends to proceed further along the same lines, in spite of the movement in favour of *small holdings*, which partially trends in the

[1] Småland here also includes Öland. West Svealand. = the Läns of Värmland and Kopparberg. North Norrland = The Läns of Västerbotten and Norrbotten.

[2] Swedish: »*Modernäring.*«

TABLE 2. *Population of Sweden in Main Groups according to Occupation.*

Professions	Population			Percentage of entire population		
	1870	1900	1910 [1]	1870	1900	1910
Agriculture and fishing .	2 995 844	2 756 704	2 663 000	71·87	53·67	48·23
Industry [2]	613 414	1 484 230	1 831 000	14·71	28·90	33·16
Trade and transport . .	210 940	544 324	670 000	5·06	10·60	12·13
Public service, etc.[3] . . .	348 327	351 183	358 000	8·36	6·83	6·48
Total	**4 168 525**	**5 136 441**	**5 522 000**	**100·00**	**100·00**	**100·00**

opposite direction, though without prejudice to the "intensity" of the farming.

The greater part of the soil of Sweden is occupied by **forests.** It is thus quiet natural that forestry should constitute one of the principal occupations of the country. It does not require the employment of so many hands as does agriculture, and consequently supports only a comparatively small number of the population. But it is one of the greatest sources of wealth in the country. Timber in fact constitutes well-nigh one half of the total exports of Sweden; and Sweden is one of the greatest seller of timber in the world's markets. Thanks to methods of forestry that are improving in efficiency year by year (since 1903 backed by an incipient legislation on the subject), the enormous capital contained in the forests is being better administered, and this source of wealth is secured and preserved for all time. Moreover with the increasing development of paper and pulp mills, furniture factories, and other industries in which the raw product is manipulated into finished articles of commerce, the wealth of the forests is being utilized more and more for the benefit of Sweden herself.

It will be noted in Table 1 that nearly 15 millions of hectares are entered as *other land,* that is, land not under cultivation. However, a considerable portion of this vast area comprises mosses, which are now being increasingly applied to useful purposes, in the shape of fuel and moss-litter. A fair amount of this land will doubtless one day be found fitted to serve for cultivation or growth of timber. The major portion of it, however, is rock and mountain, and thus "uncultivable" land; but not worthless. For in these desert regions Nature has buried one of Sweden's greatest treasures: the boundless iron ore fields. They form a belt extending across the central part of the country, and contain the purest ores in the world. The main mass of ore, however, is to be found in Lappland, which until quite recently was inaccessible. but which the railway has now opened up to the world's markets. Many other mineral treasures lie buried in the Swedish mountains. Thus, as might have been expected, **Mining** has been from time immemorial the leading industry of the country. Sweden was in fact long the biggest producer of iron in

[1] Approximate estimate. — [2] Includes forestry and mining. — [3] Includes the literary, artistic, and medical professions, the administration of charity etc.

Europe, until the use of coal for the manufacture of pig-iron revolutionized that industry. The lack of fossil fuel has in fact since that time proved the chief obstacle to the development of such an industry on a scale corresponding to the natural resources. This lack is also the reason why at present mining in Lappland merely concerns itself with the raw product. The mining of ore, which is moreover carried on from the ore fields of Central Sweden, has thus become one of the biggest export industries of the country. The recent development of iron works, foundries, machine shops, and so forth, shows, however, that the way is being gradually prepared for a manufacturing industry of great magnitude.

The lack of coal (there is only a scanty supply in the north-west of Skåne), in conjunction with difficulties arising from the enormous distances that have to be traversed, explains why **Mechanical Industry** in Sweden has so long remained in a state of insignificance. However, in the course of the last twenty years or so a distinct change in this regard has taken place. Numbers of new lines of manufacture have been struck out, and established lines have increased many times over the scope of their activities; the result is that the value of the output has risen enormously, being computed for the year 1912 at about 1 778 million kronor (exclusive of forestry, mining, and dairy-farming), while the population which derives its livelihood from mechanical industry has been well-nigh trebled since 1870. Industry on a big scale has thus made its ingress into Sweden, and is perhaps destined to give her a position sooner or later among the principal centres of the world's industry: for, if Sweden lacks coal, she possesses an abundance of *waterfalls*. The Swedish waterfalls, as a rule, are not so easy to equip as the Norwegian; but the utilization of electric power is gradually gaining territory, and is bound sooner or later to embrace in its sweep not merely mechanical industry, but also mining and the railway. The time is surely not far off when the "white coals" will in these domains to a great extent supersede the black. — Here as in other spheres **handicraft** is being jostled aside in the onward march of mechanical industry, in order, having accommodated itself to the new conditions, once more to win for itself a secure position alongside of the latter. Thus, the old domestic sloyd has sprung up into life once more and, in many districts, now, as before, assumes an important place in the economy of the country people.

Commerce and **Transport** come next on the list of important occupations. Owing to the great extent of coast-line, the numerous harbours, and the well-developed system of water-ways (big lakes and long canals) navigation in the interior of the country is very brisk; and in consequence of the great differences between the products of the various provinces, a busy interchange of commodities takes place within the country itself. By a railway system which in proportion to the population is the biggest in Europe, the great distances have been bridged over, and the country has been opened up to the markets of the world. Trade with foreign

countries has also made great advances in the course of the last few years; however, it doubtless still admits of considerable development. This may be said with still more truth of **Shipping,** which a newly-awakened interest has aroused out of the torpor into which it had sunk, in consequence of various unfavourable conditions, during the last quarter of the nineteenth century. Several new direct lines to foreign parts of the world and the steadily increasing tonnage of steamers testify forcibly to the reality of this awakening.

Fishing is in Sweden an occupation of minor importance, although, owing to the return of the herring to the Swedish coast, improved methods of sea-fishing, and a more scientific pisciculture, it has in recent years yielded a continually richer harvest.

Shooting, which was formerly a very important means of subsistance, can no longer be reckoned as a special branch of industry. It must be regarded now, to a great extent, merely as a means of recreation and a sport.

Banking finally, which supplies to modern industrial life its motive power, capital, has attained a high pitch of development in the form of savings-banks, land mortgage-banks, and commercial banks proper. Both by administering the floating capital of the country, and by advancing money for productive work, it contributes largely to the promotion of industry. A richly developed *insurance* system guards against the various risks which menace property.

It will be apparent even from this brief survey that the sources of livelihood in Sweden are extremely rich and varied. It will also be manifest that Sweden has for a generation been undergoing a process of transformation, the tendency of which is to *convert the manufacture of the raw article into the manufacture of the finished article,* and to *apply industrial methods to all spheres of occupation.* Sweden is thus undergoing the same process of development as the great civilized countries have already undergone. In Sweden too this development is attended by a steadily increasing prosperity and a rapidly augmenting national revenue. We shall endeavour briefly to sketch also this aspect of Sweden's national economy with its most recent developments.

However, before we pass over these calculations, we shall adduce a few data as to the course af development in this domain during the last half-century.

Sweden's Economical Development between the Years 1862 and 1913.

The prevailing feature of Sweden's national economy during the last half-century is a vigorous development. This development has gone on in spite of the fluctuations between *bad* and *good* times which have occurred during that period, and which now recur with great regularity.

In former days bad harvests and wars were the chief causes. Nowadays it is the rythm of economical life itself that causes the bad times

to alternate with the good. At the same time these fluctuations have become universal. Even the most out-of-the-way regions are affected by things happening at the other end of the world. Along with these big waves in the ocean of the world's market there are also minor eddies, of a more local character, which condue to reinforce or neutralize them. Thus the period from 1866 to 1870 was as a whole a particularly unfavourable one for Sweden. But the cause was mainly local, viz. the bad harvests of the years 1866, 1867 and 1868 — as a matter of fact the last time in the history of Sweden that these domestic causes affected the ebb and flow of national economy. Since that time domestic conjunctures have almost without exception coincided with those of the world's economy as a whole.

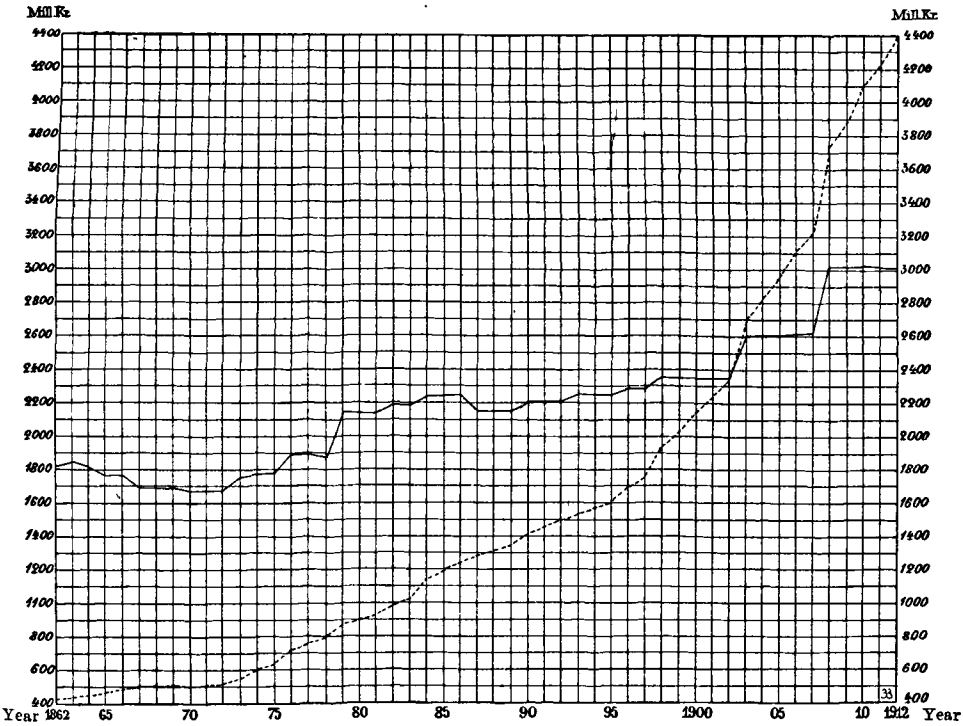
The former half of the seventies of the last century is universally known as a period of unparalleled economic progress, and not least in Sweden, where the reaction that inevitably ensued did not set in till about 1878. The period from 1879 to 1887, on the other hand, was almost everywhere, with short intervals, a period of stagnation, and, in general, things were not much better during the years 1888 to 1893. Swedish agriculture in particular, like European agriculture at large, passed through a severe crisis during the whole period from 1879 to 1893. After 1893 agricultural conditions improved; but already previous to that year Swedish industry had entered on a phase of magnificent development, which after the year 1894 coincided with the general economical expansion that marked the period down to the crisis of 1907. The relative stagnation which then set in both in Sweden and elsewhere was prolonged, owing to domestic conditions, particularly disturbances in the labour market (the general strike of 1909), beyond the actual period of crisis, and it is only after the general economic rise which marked the year 1913 that Swedish enterprise seems to be recovering its confidence. In this

TABLE 3. *Assessed Value of Real Property in Sweden.* In millions of kronor.

Year	Total value of real property			Owned by			Real property in private hands		Real property belonging to the State	
	Landed	Other	Total	Private persons	The State[3]	Communes[1]	Landed	Other	Landed	Other
1862 . . .	1 844	470	**2 314**	2 247	31	36	1 827	420	17	14
1870 . . .	1 691	597	**2 288**	2 165	46	77	1 666	499	25	21
1876 . . .	1 931	850	**2 781**	2 614	62	105	1 898	716	33	29
1879[2] . .	2 209	1 052	**3 261**	3 011	124	126	2 142	869	67	57
1884 . . .	2 322	1 363	**3 685**	3 378	151	156	2 241	1 137	81	70
1887 . . .	2 239	1 533	**3 772**	3 439	158	175	2 159	1 280	80	78
1900 . . .	2 494	2 536	**5 030**	4 502	253	275	2 355	2 147	139	114
1910 . . .	3 236	4 898	**8 134**	7 136	438	560	3 025	4 111	211	227
1911 . . .	3 237	5 101	**8 338**	7 299	459	580	3 026	4 273	211	248
1912 . . .	3 237	5 248	**8 485**	7 426	465	594	3 025	4 401	212	253
1913 . . .	3 740	5 837	**9 577**	8 266	565	746	3 480	4 786	260	305

[1] Communes and communities. All the real property included here is reckoned as "other property" (than landed, i. e. agricultural). — [2] See the text on p. 20. — [3] Low assessment

Assessed Value of Taxable (i. e. private) Real Property.



way, the temporary interruptions in the economic development of the country, caused by unfavourable junctures and other circumstances, have invariably been followed by a still brisker march forwards. It is to be hoped that this will also prove to be the case after the recent period of depression.

The outer signs of this development are visible in all spheres, immaterial as well as material. We shall confine ourselves here to a general survey of certain of these signs, principally the growth of fixed capital and of income, as far as one can judge from assessments of taxes.

Statistics of Taxation in their present condition date back to the year 1862. Triennial (since 1898 quinquennial) official assessments have been made (by communal deputies) of the value of all *real property* — as strict distinction being always made between landed property used for agricultural purposes and other kinds of real property. Thus under the head of *landed property* is included the main body of the soil, i. e. all except the ground used for building sites in cities and country-towns as well as for the erection of factories and means of communication; further, all buildings erected on that soil, belonging to the landed property, as well as forests and deposits of ore, only excepting mines, and waterfalls applied to industrial purposes, and large fisheries. *Other property* includes building sites in cities, country-towns, and places of equivalent impor-

TABLE 4. *Total Income from Real Property, Capital, and Work.*[1]

Annually	Mean population	A. 5 % of the value of real property	B. Income from capital and work	Total	Per inhabitant		
		Kronor	Kronor	Kronor	A.	B.	Total
1866—70 . .	4 166 000	115 977 000	160 427 000	**276 404 000**	28	38	**66**
1871—75 . .	4 274 000	121 320 000	225 098 000	**346 418 000**	28	53	**81**
1876—80 . .	4 500 000	150 565 000	286 286 000	**436 851 000**	33	64	**97**
1881—85 . .	4 605 000	177 271 000	326 976 000	**504 247 000**	38	71	**109**
1886—90 . .	4 742 000	192 502 000	368 269 000	**560 771 000**	40	78	**118**
1891—95 . .	4 832 000	209 917 000	437 472 000	**647 389 000**	43	91	**134**
1896—00 . .	5 032 000	236 689 000	602 125 000	**838 814 000**	47	120	**167**
1901—05 . .	5 230 000	286 841 000	839 766 000	**1 126 607 000**	55	160	**215**
1906—10 . .	5 429 000	370 078 000	1 185 807 000	**1 555 885 000**	69	218	**287**
1910	5 522 000	406 684 000	1 253 993 000	**1 660 677 000**	73	227	**300**
1911	5 542 000	416 920 000	1 445 851 000	**1 862 771 000**	75	261	**336**
1912	5 604 000	424 279 000	1 519 007 000	**1 943 286 000**	76	271	**347**
1913	5 621 000	478 881 000	1 655 351 000	**2 134 232 000**	85	295	**380**

tance, buildings on the said sites, and further, premises and buildings on agricultural property which are not intended for agricultural purposes, large fisheries, and fee-farm rents. Thus all the real property of the realm, except channels of communication (canals and railways) with the buildings appertaining to them, is entered in the assessment rolls at its estimated value. On the other hand, no calculation is made as to the yield of real property in monetary value. But this is done in the case of *capital* and *work*, the income for every taxpayer being assessed by the same authorities as those just mentioned; this assessment takes place annually.

In consequence of the different methods of procedure referred to above, it is not possible to determine the total annual income of the Swedish nation, but one must content oneself with two incommensurable sets of figures; on the one hand, the *value* of real property, on the other the *income* derived from work and public service. It is true that since 1911 (Law of the 28th Oct. 1910) owners of real property, both landed and other, are taxed for income derived from such property. However, the incomes thus declared do not yet by any means correspond to the real incomes; we must therefore content ourselves with the data of past years on the one hand as to the value of real property, and on the other as to income from capital and work.

The results in both cases are given in summarised form in Tables 3 and 5. In Table 4 an attempt has also been made to amalgamate the assessed income and 5 % of the assessed value of real property — of course without any claim in the latter case to give the real net profit, but merely an approximate idea of the total sum. However, for various reasons, it is probable that the latter by no means corresponds to the real annual income of the Swedish people.

The *value* of all *real property* in Sweden has thus from 1862 to 1913 increased from 2 314 to 9 577 million kronor, that is, has been more than quadrupled. Agriculture, however, shows a comparatively small advance, from 1 844 to 3 740 millions, an advance which may even, to some extent, be due to a more accurate valuation (from 1879 onwards). Other

[1] The income from real property is here assumed to be 5 % of the assessed value. See the text on p. 21.

real property (houses, buildings, factories etc.), on the other hand, exhibits an increase of value from 470 to 5 837 million kronor, that is, thirteen times as much.

The income from capital and work proves to have risen since the period 1866—70 from 160 million kronor to 1 655 million kronor, that is more than ten times as much. The income derived from "business or trade" in particular has swelled from 93 million kronor to 576 million kronor, that is, six times the former amount.

These figures point to an enormous increase during the past generation. And, even if part of it is to be ascribed to inaccurate assessment during earlier years of the period, and part to the fall of money value during the later years of the period, it nevertheless remains an incontestable fact that during this time there has been a very considerable advance in the value of real property and income derived from work.

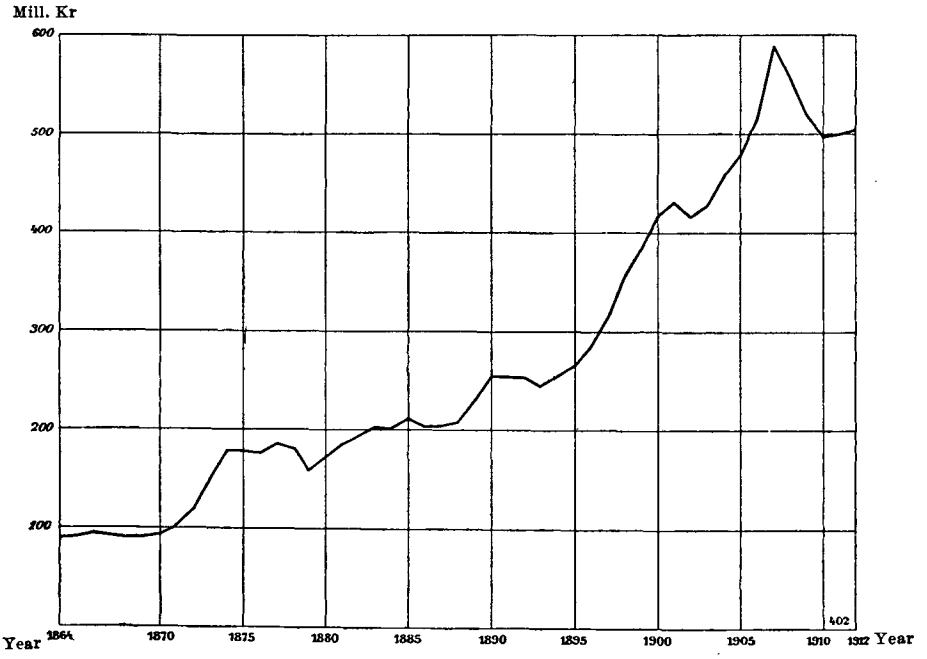
Not less remarkable than the development which has thus been sketched is that which is observable with regard to capital in the strict sense, that is the *sums deposited by the general public in savings-banks and other banks.* The absence of complete statistics renders it impossible to follow this matter in detail from early years. We know, however, that in 1862 these sums amounted in round figures to 54 million kronor. After that year the data are, for various reasons incomplete, until in 1874 they include all banks with the exception of the so-called people's banks, accounts of which are not accessible until the years from 1892 onwards. However, the sums deposited in the people's banks represent comparatively small

TABLE 5. *Specification of Income from Capital and Work.* In kronor.

Annually	From capital	From public service	From private service	From business or trade	Total
1866—70 . .	16 831 000	32 617 000	18 162 000	92 817 000	**160 427 000**
1871—75 . .	18 227 000	36 953 000	24 079 000	145 839 000	**225 098 000**
1876—80 . .	22 343 000	50 564 000	38 418 000	174 961 000	**286 286 000**
1881—85 . .	26 050 000	56 871 000	45 538 000	198 517 000	**326 976 000**
1886—90 . .	27 138 000	62 863 000	57 893 000	220 375 000	**368 269 000**
1891—95 . .	28 545 000	70 577 000	83 741 000	254 609 000	**437 472 000**
1896—00 . .	32 915 000	81 892 000	136 604 000	350 714 000	**602 125 000**
1901—05 . .	49 641 000	349 111 000		441 014 000	**839 766 000**
1906—10 . .	72 572 000	577 602 000		535 633 000	**1 185 807 000**
1910[1] . . .	77 821 000	678 885 000		497 287 000	**1 253 993 000**
1911	84 443 000	862 314 000		499 094 000	**1 445 851 000**
1912	89 036 000	925 305 000		504 666 000	**1 519 007 000**
1913	90 041 000	989 388 000		575 922 000	**1 655 351 000**

[1] It should be noted that the figures of income from capital, business or trade, for the year 1910, (figures which, it should be borne in mind, give the income of the *previous* year, 1909) not only fail to show the usual rise as against preceding years, but actually a pretty considerable falling-off, viz. altogether 24 million kronor. This was due to the general strike of 1909. This was naturally also the case with the income derived from private service; but a rearrangement of the "General Summary" (Generalsammandraget) of taxes prevents us from obtaining a clear view of the matter.

Assessed Income derived from Business or Trade.



amounts (1893: 13·4 million kronor), and thus this lack of completeness only very slightly affects the result.

This enormous increase in the deposits of the general public in banks of different kinds is, of course, not only to be ascribed to the growth of floating capital during this period. It was due, especially during the first two or three decades, not a little to the fact that this capital has been in an

The Deposits of the General Public in Savings-Banks and other Banks.

Year	In thousands of kronor	Year	In thousands of kronor
1862	54 000	1894	777 573
1874	314 976	1895	821 242
1875	325 496	1896	870 995
1876	358 581	1897	960 826
1877	362 264	1898	1 066 268
1878	346 681	1899	1 183 279
1879	355 144	1900	1 286 919
1880	392 725	1901	1 381 571
1881	415 410	1902	1 448 060
1882	446 096	1903	1 524 594
1883	480 722	1904	1 603 405
1884	515 780	1905	1 715 570
1885	538 358	1906	1 884 299
1886	561 019	1907	2 055 540
1887	574 895	1908	2 162 994
1888	591 213	1909	2 229 472
1889	613 553	1910	2 330 782
1890	639 911	1911	2 431 652
1891	672 129	1912	2 566 284
1892	690 157	1913	2 705 952
1893	734 926		

increasingly great degree entrusted to the banks for administration. Formerly it passed from hand to hand in the form of private loans and advances. Now the banks have become the chief negotiators of capital as well as the bankers of the public. It is to this great revolution in the economy of the Swedish people that the figures above given primarily point. But they also teach us, particularly as to recent years, that the growth of capital has been very considerable, though — as we shall see below — not sufficient to cope with the demand for floating capital which has been increasing in a still greater measure during these years.

The development which has been sketched in its main outlines is to be seen in all departments of economy, and not only in economy, but in many other aspects of the life of the people. There is, in particular, one circumstance relating to population which clearly reflects this development, and which must therefore be briefly touched on here. We refer to *mortality in the first year of life*. This is perhaps, broadly speaking, the safest gauge of the advance and prosperity of a nation.

Other data relating to population, marriages, births, immigrations, and emigrations, depend on many subjective factors, such as men's wishes and decisions besides matters of economy; but with regard to mortality, economical factors are of predominating importance. This is not gainsaid by the fact that mortality is greatly affected by the development of science, public hygiene, and public education. For in the last resort these latter also must be regarded as functions of the general economic situation. They are promoted by private and national prosperity, kept down by general poverty.

The data just referred to will be found in the subjoined table, which, as well as infant mortality, gives the general mortality affected by the latter.

These figures afford a splendid testimony to the advance made by the Swedish nation, with regard to the most important factor of the people's economy, namely the people itself. General mortality has in the course of the last fifty years decreased by about 6 ‰, and infant mortality by about 60 ‰, the average length of life accordingly increasing by about 11·19 years. This in itself forcibly attests the improvement in the condition of the masses. The most remarkable point, however, is that mortality in the first year of life has during this period become independent of the vicissitudes of the times. In the sixties of the last century one can still trace the connection between the circumstances of the time and infant mortality. During the bad harvest years 1866, 1867, and 1868, infant mortality rose considerably, as in former times it invariably did in bad years. But after this time it is no longer possible to observe any such connection. The death-rate is higher during the good years 1872 to 1876 than during the ensuing bad years from 1879 to 1893. Similarly it rises during the extremely good years from 1899 to 1901, whereas it has never been lower than during the recent period of crisis (1907 to 1910). Nowadays it is no longer economical conditions, but quite different factors,

TABLE 6. *Mortality in Sweden.*

Year	Death-rate per 1000 of the mean population	Death-rate in the first year of life per 1000 births of living children during the year	Year	Death-rate per 1000 of the mean population	Death-rate in the first year of life per 1000 births of living children during the year
1861	18·47	137·3	1886	16·61	111·2
1862	21·40	139·3	1887	16·13	103·1
1863	19·33	132·6	1888	15·99	100·3
1864	20·25	136·7	1889	15·99	107·2
1865	19·36	135·1	1890	17·12	103·1
1866	19·98	126·9			
1867	19·64	140·1	1891	16·81	107·9
1868	20·98	168·3	1892	17·88	109·2
1869	22·27	145·8	1893	16·83	101·2
1870	19·80	131·9	1894	16·38	100·9
			1895	15·19	94·7
1871	17·21	113·7	1896	15·64	103·3
1872	16·28	128·3	1897	15·35	98·6
1873	17·20	128·8	1898	15·08	90·8
1874	20·32	146·7	1899	17·65	111·7
1875	20·27	149·0	1900	16·84	98·5
1876	19·59	140·2			
1877	18·66	125·5	1901	16·05	102·9
1878	18·06	134·2	1902	15·37	86·4
1879	16·94	111·2	1903	15·09	92·8
1880	18·10	120·7	1904	15·29	84·4
			1905	15·62	88·3
1881	17·68	112·7	1906	14·37	81·0
1882	17·35	124·6	1907	14·59	76·8
1883	17·31	115·7	1908	14·91	85·4
1884	17·53	113·2	1909	13·67	72·2
1885	17·75	114·3	1910	14·04	75·1

such as temperature, temporary outbreaks of epidemic diseases among the people, that determine the rate of infant mortality. This proves that the masses have reached a point above the "bare minimum required for existence", when every temporary deterioration of the economical situation makes itself felt in an increase of infant mortality. The Danes and the Norwegians appear to be the only nations that can exhibit a case like this. The great civilized countries surpass Sweden in national riches, but not in national prosperity. Nowhere has infant mortality, accordingly, descended as low as among the Scandinavian peoples. The economic development of the past generation has in Sweden been attended by an improvement in the condition not only of the rich, but also of the common people: this is the gladdening result which these figures point to.

The scattered indications given above of the progress made by the Swedish people during the past generation are fully endorsed by the assessments of the wealth of the nation that have been made from time to time, and to which we shall now pass over.

The National Wealth.

The aggregate possessions of a country or people, in other words, the national wealth, is the sum of the material property and foreign claims

in the possession of the nation and of the individuals who compose it, and constituting the means of subsistence of both.

A calculation of a nation's revenue and wealth is one of the most difficult tasks that statistics can have to deal with. And indeed it is impossible at the present moment to supply a perfectly exact investigation of this nature. But even an approximate estimate is of the greatest interest. It furnishes, so to speak, a balance-sheet and inventory of a nation's assets and property in general, or, to employ another metaphor, a snap-shot of them. And even if the individual features are not quite distinct, yet nothing can present such a concise general view of the economic status of a nation as an estimate of its total assets, in movable and real property, in natural products and the yield of work.

The best method of computing the wealth of a nation is to specify as accurately as possible the different items of which it is composed, and then to endeavour to ascertain the value of each separate item, basing the estimate on the prices which prevail in purchase and sale, or, where that is not feasible, to take the net yield, the cost of production, or insurance values.

This is the so-called "objective method", a more detailed account of which will be found in the following works: *P. Fahlbeck, Sveriges nationalförmögenhet,* Stockholm 1890, and *Sveriges nationalförmögenhet omkring år 1908 och dess utveckling sedan mitten av 1880-talet, Finansstatistiska utredningar utg. av Kungl. Finansdepartementet,* V. Stockholm 1912, the latter by *I. Flodström.*

Assessments of the national wealth of Sweden on this basis have been made at three different dates, viz. in 1885, 1898, and 1908. In order to obtain complete commensurability between these three calculations, it has been necessary in some cases, in making the later assessments to rectify the earlier. Thus the value of landed property and of the crown lands included under that head, which in 1885 had been put at 2 744 million kronor was in 1898 raised to 3 093 million kronor; similary stores, machines, and personal movable property were raised from 1 130 to 1 380 million kronor. Again in the total estimate for the year 1908 the figures for the live and dead stock of agriculture in the assessment of the year 1898, which in this case was merely a rough calculation, were raised from 441 and 139 million kronor to 500 and 180 million kronor respectively, and in conformity therewith stores, machines, and personal movable property were lowered from 2 324 to 2 272 million kronor. On the other hand, in the assessment ot the year 1908 certain adjustments have been made as regards fisheries and fishing-waters, as well as means of communication, specie, and foreign claims, in order to obtain complete uniformity with previous assessments. With respect to these rectifications, and to the method of calculation as a whole for each separate item, the reader may be referred to the above-named works, and to pp. 454 foll. of the first edition of this work.

Putting together these three estimates, and noting that objects of art, war material, the vessels of the royal navy, and fortifications are entirely excluded, we obtain the values in Table 7.

The advance in national wealth to which these figures point is a very considerable one, both in proportion to the population, the quota per head, and in each separate item. A remarkable point is the great difference in percentage of annual increase during the two periods 1885—1898 and 1898—1908. In the main the great increase during the later period is doubtless quite genuine, particularly with regard to "other real property" (house-building in the cities), stores and machines etc., as well as mines. During this decade Swedish industry, and mechanical industry in parti-

TABLE 7. *Estimated Value of the National Wealth.* In thousands of kronor.

	1885	1898	1908	Average increase per annum from 1885 to 1898		from 1898 to 1908	
				mill. kr.	%	mill. kr.	%
Landed Property	3 093 000	3 100 000	3 679 000	0·5	0·02	57·9	1·73
Other Real Property	1 459 000	2 349 000	4 667 000	68·5	3.73	231·8	7·09
Live Stock	441 000	500 000	660 000	4·5	0·97	16·0	2·82
Agricultural Dead Stock	139 000	180 000	322 000	3·2	2·01	14·2	5·99
Stores, Machinery, Personal Movable Property	1 380 000	2 272 000	3 711 000	68·6	3·91	143·9	5·03
Mines and other large Metalliferous Deposits	43 000	92 000	518 000	3·8	6·03	42·6	18·86
Fisheries and Fishing Waters	37 000	45 000	86 000	0·6	1·52	4·1	6·69
Means of Communication	442 000	761 000	897 000	24·5	4·27	13·6	1·66
The Merchant Navy	79 000	104 000	163 000	1·9	2·14	5·9	4·60
Bullion and Specie	44 000	69 000	111 000	1·9	3·52	4·2	4·87
Claims on Foreign Countries	50 000	98 000	331 000	3·8	5·31	23·3	12·94
Total	**7 207 000**	**9 570 000**	**15 145 000**	**181·8**	**2·20**	**557·5**	**4·70**
Deductions for Foreign Liabilities	664 000	570 000	1 332 000	—7·2	—1·18	76·2	8·86
Balance	**6 543 000**	**9 000 000**	**13 813 000**	**189·0**	**2.48**	**481·3**	**4·38**
Per Head of Mean Population	1 403	1 787	2 557	—	—	—	—

cular, carried forward at an increasingly rapid pace the development which set in during the nineties of the last century. During this time a great number of "new values" have been created, or, as in the mines of Lappland and the water-falls, so to speak, been discovered and converted to use. But one factor accrues that makes the increase of value appear greater than it actually was: the decreasing value of money made itself felt precisely during this decade. How much of the increase during this time is to be put to that account, it is by no means easy to say. A detailed investigation of this question is given in *Flodström's* above-mentioned work, pp. 283 foll., to which the reader is referred. But, even if the figures for 1908 must me reduced by from 8 to 10 % in order to bring them into line with those immediately preceding, nevertheless the increase as a whole has been very considerable. The Swedish national wealth has grown enormously in the course of the last quarter of a century, and is increasing yearly by considerable amounts. These are the gratifying facts which these assessments reveal. That the national income, i. e. the yield of work with the aid of capital, has risen still more, is proved by the increase of assessed income (see above), as well as by the greatly improved conditions of existence in all classes of society during this period.

However, there is a dark spot in the otherwise bright picture: the greatly augmented debt to foreign countries. This however, hangs together with the rapid development of industrial life as a whole, and of communications in particular; one seems thus justified in hoping that Sweden's debt to foreign countries will gradually diminish.

III.

RURAL HUSBANDRY.

From early times agriculture has customarily been described as the chief industry of Sweden, but nowadays it does not, for several considerations, possess the same right to this title that it once did. For one thing, the number of the persons engaged in agriculture has not increased in the same proportion as the total population of the country; the total of those engaged in this pursuit, who during the twenties and thirties of last century, amounted to 82 % of the entire population, formed at the last census in 1910 only 48 %. Since the year 1880, there has even been an absolute decrease in the agricultural population, from 3 078 000 in the year mentioned to about 2 663 000 in 1910. This decrease, which has occurred simultaneously with an increase in the crops produced, means, of course, that greater economy has begun to be practised with regard to expensive human labour, but, while such economy still can, and in many respects ought to be still further extended, the diminution in the supply of labourers, has, in many places, made it distinctly difficult to carry on the work with undiminished intensity.

But even if the area of the cultivated land, as well as the returns obtained from it, have been steadily on the increase, this increase has not kept pace with the growing need of the population for the necessaries of life; but, as will be shown below, Sweden, after having had, at least in some earlier periods, a considerable surplus of grain, has now become obliged to import very large quantities of cereals, etc., and as the export-surplus of cattle and animal-products that has simultaneously arisen does not cover the import-excess of grain, the product of Swedish agriculture, taken as a whole and calculated according to values, no longer satisfies the demands of the population of the country for the necessaries of life.

It must be considered in this connection that agriculture, which, in the middle of the 19th century, was the only Swedish industry of

Note. With reference to the altered organization of the respective Statistics, older figures are in certain cases retained in this Section.

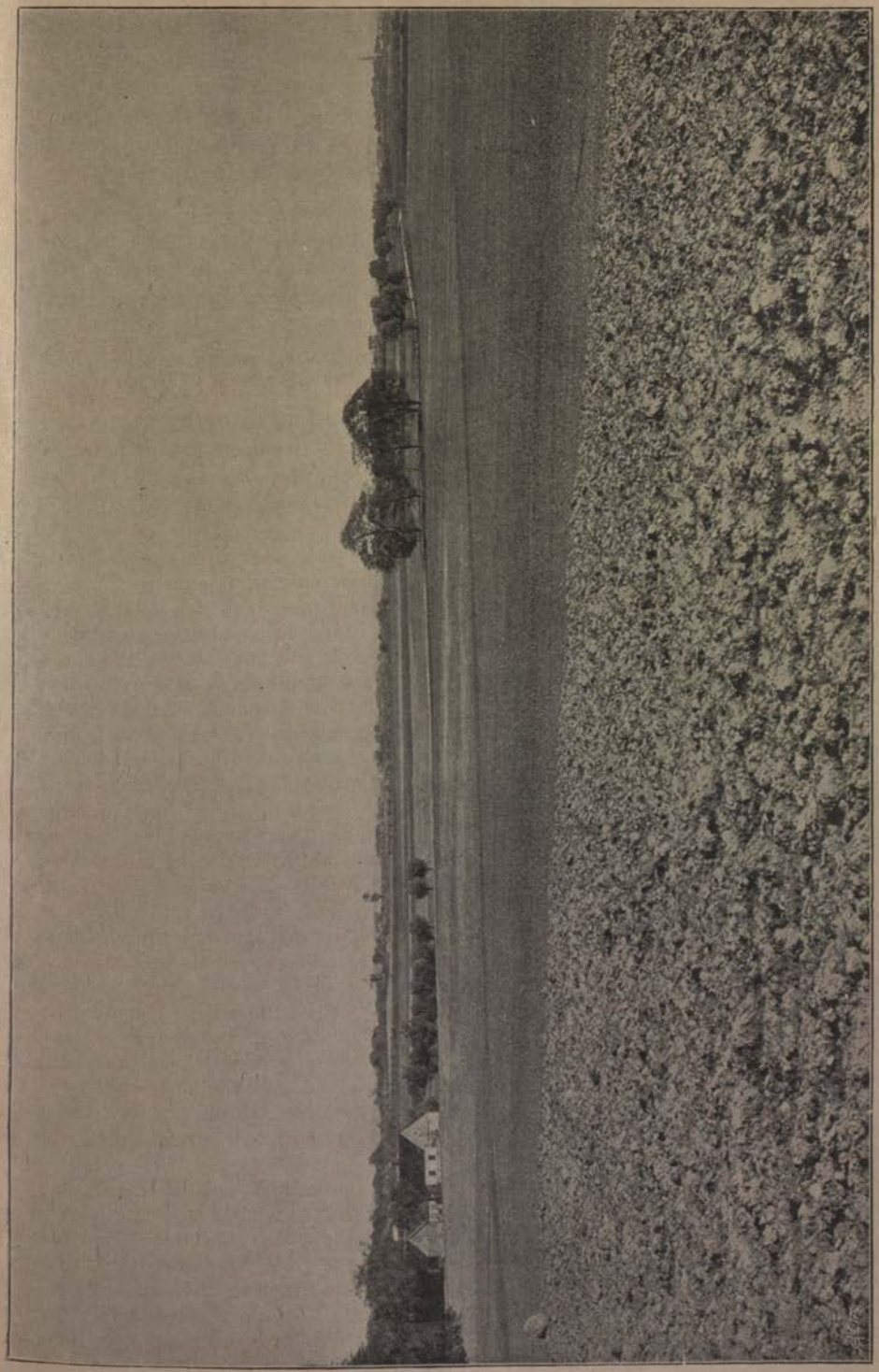
any importance, is now considerably exceeded in product-value by manufacturing industries taken as a whole. The harvests of the country during the last few years have been estimated at an annual value of about 800 million kronor; (figures for the manufacturing industry, as not being fully comparable, are not given here). Among the individual branches of industry, however, agriculture still occupies the chief place, both as regards the number of persons engaged in the occupation and also as regards the value of the products and the fundamental importance of the industry for the economic and social life of the people. Of all the countries of Western Europe, it is only Denmark and Finland of which this holds good in a higher degree than for Sweden.

If, therefore, agriculture in Sweden no longer occupies the same dominating position among the industries of the country as it did in earlier times, and if it cannot supply the population with the necessaries of life to the same extent that it once did, still its development in point of extent and returns have been important, although very unequal, both during different periods and in various parts of the country.

While the total of the acreage under cultivation increased in about the same proportion as the population, the technical and economic arrangements of agriculture and live stock husbandry remained at about the same stand-point, even during the early part of the 19th century, that it had occupied during the reign of Gustavus Vasa, almost three centuries earlier. It is true that, during the epoch known as the Period of Liberty (the middle of the eighteenth century), when care was paid, above everything, to the increase in and improvement of the national industries, much attention was also devoted to agriculture; learned investigators busied themselves very much with questions in connection with the subject (C. v. Linnæus, the renowned botanist, and J. G. Wallerius, the first agricultural chemist, are specially worthy of mention in this respect), and a large number of publications on the subject of agriculture made their appearance, but the studies and teachings of the scientists were made but little use of in practice, and statesmen estimated the value of agriculture chiefly in respect to its power to produce raw material for manufacturing industries, and to render the importation of various kinds of goods unnecessary. The progress made by agriculture, therefore, was inconsiderable, and what was made was hindered by the way in which the land was at that time distributed.

In Sweden, as in almost all other European countries, the village communities originally held the soil in common, but the transition of the tenure of land from common to private property had already before historic times proceeded so far that all enclosed land, viz. the cultivated land and the meadows, were divided among all the part-owners in the village community, the wastes, that is the forest and other land beyond the limit-marks, still being retained as the common land of the village.

This partition, though, had taken such a direction that each field was parcelled among all the part-owners, each land-owner thus obtaining an estate formed of many scattered unfenced parcels, mingled with the plots belonging to all his fellow-villagers. This splitting up of the land was a great hindrance to cultivation, making it necessary for all the neighbours to perform their agricultural operations at the same time and in the simplest manner possible, every attempt at introducing improvements being thereby paralyzed. The first attempt that was made to do away with this unsatisfactory state of things



Landscape near Alnarp, in Skåne.

TABLE 8. *Imports and Exports of Agricultural Products.* Value in thousands of kronor.

		Annually 1871—75	Annually 1876—80	Annually 1881—85	Annually 1886—90	Annually 1891—95	Annually 1896—00	Annually 1901—05	Annually 1906—10	Year 1911	Year 1912
Grain, unground	imp.	9 725	18 158	30 395	20 491	26 551	31 855	46 870	46 495	45 276	65 099
	exp.	35 934	38 309	27 130	17 365	14 773	3 382	1 103	1 047	4 541	1 529
Flour	imp.	9 467	13 582	10 429	7 843	5 928	2 542	2 136	3 088	2 506	4 073
	exp.	873	823	1 695	990	251	485	577	508	920	1 072
Other agricultural products[1]	imp.	2 539	2 757	2 846	3 214	3 598	8 868	14 035	27 818	12 175	13 071
	exp.	109	238	337	236	220	276	236	2 342	1 112	2 437
Live stock	imp.	610	939	1 421	1 169	795	1 126	1 303	2 699	1 709	3 055
	exp.	6 867	6 432	8 752	8 815	5 059	3 046	2 880	5 751	14 766	16 480
Meat, pork, sausages	imp.	6 985	10 141	8 285	6 008	4 983	6 112	5 637	4 428	3 084	3 553
	exp.	285	190	548	3 386	6 161	2 413	3 076	2 191	12 552	17 875
Butter and margarine	imp.	2 395	3 554	4 054	3 333	1 943	1 768	958	638	453	410
	exp.	6 098	8 540	15 202	25 438	38 323	40 491	36 726	37 514	46 831	46 106
Wool	imp.	6 320	4 486	5 428	6 874	4 820	7 332	12 301	15 406	13 288	19 620
	exp.	86	48	81	87	49	111	354	217	138	401
Raw hides	imp.	6 343	2 957	3 697	2 991	2 611	5 036	8 465	11 872	13 843	15 571
	exp.	650	593	753	1 096	1 288	3 174	5 435	7 066	13 564	15 309
Other products of cattle breeding[2]	imp.	2 199	2 708	2 812	1 960	1 998	4 528	7 997	9 178	6 861	8 477
	exp.	575	425	627	953	857	533	1 112	2 813	3 739	3 401
Total	**imports**	**46 583**	**59 282**	**69 367**	**53 883**	**53 227**	**69 167**	**99 702**	**121 622**	**99 195**	**132 929**
	exports	**51 477**	**55 598**	**55 125**	**58 366**	**66 981**	**53 911**	**51 499**	**59 449**	**98 163**	**104 610**

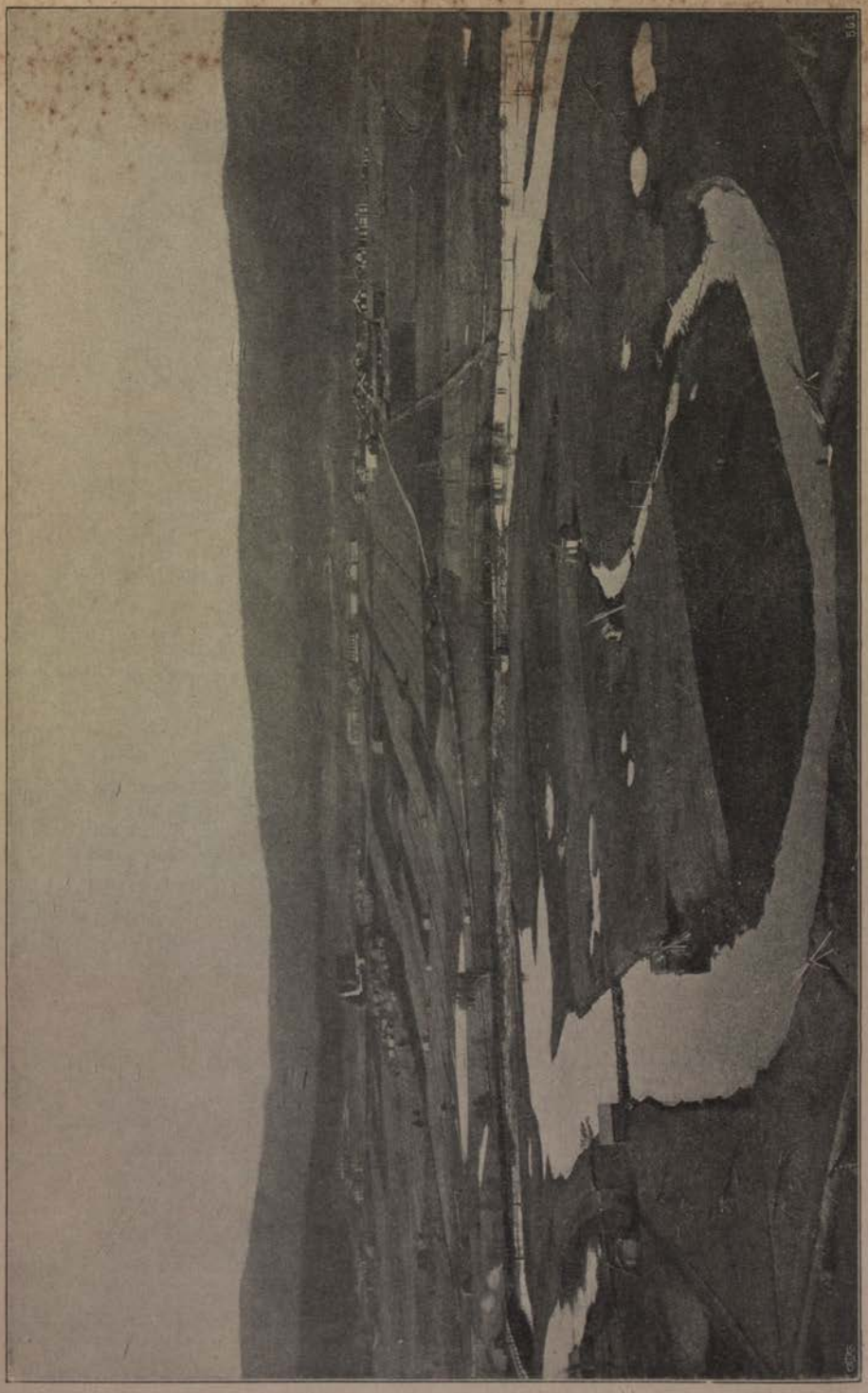
[1] Bread, starch, yeast, bran, potatoes, flax, and hemp. In 1899 the import of potatoes amounted to no less than 4·24 mill. kronor, in consequence of the failure of the crops. — [2] Cheese, eggs, tallow, suet, horse-hair, etc.

was the issue in 1749, at the instance of *Jakob Faggot*, director of surveying, of a Regulation, in accordance with which the surveyors had to endeavour to induce the landowners so to carry out the division of the estates that the parcels of land falling to each owner might become as large as possible. By the Regulations for the *General Re-partition of Land* (storskifte), which were issued on April 5, 1757, another step was taken in the same direction, as the Regulation in question gave every landowner in the village full and unrestricted liberty to demand such a general re-partition. But the work of the general re-partition of the land went on but slowly, and fulfilled its purpose but imperfectly, as it was impossible to reduce the parcels of land belonging to one owner, against his will, to a lower number than four lots of cultivated land and as many of meadow. The insight of the advantages to be gained by the aggregation of the plots of land became stronger and more general, however, and it was partly as a result of the brilliant economic success that had crowned the efforts made by the Scanian landowner, Baron *Rutger Maclean*, so to divide his estate of Svaneholm that each tenant obtained the whole of his land in one piece, that there were issued, in 1803 for Skåne, in 1804 for Skaraborg Län, and in 1807 for the whole of the country, Regulations for the *Separate Re-partition of Land* (enskifte), according to which each landowner in a village was given the right to demand to have all his share of reclaimed land in one piece.

Manor house, Gammelbo in Vestmanland.

But such a radical reform met with great difficulties and with much opposition, however, and so a fresh Regulation for a re-partition of the land was issued on May 4, 1827, according to which by *legal re-partition of land* (laga skifte), the parcels that were to fall to the share of the various claimants should form as connected plots as their character and situation permitted, without injury to any of those sharing the land. It was in accordance with this Regulation that there was carried out, during the two following decades — although very often it met with great opposition — the re-partition of the land over the greater part of the country south of Norrland and Dalarne, this step paving the way for various important improvements in agriculture (cf. also Official Cartography).

During the first half of the 19th century, the efforts made to increase the crops were chiefly directed to bringing new tracts of land under the plough for



Landscape from Central Norrland, Ånundsjö in Ångermanland.

the purpose of raising grain, and the decade immediately following the Union with Norway in 1814 seems to have been a most successful period of cultivation of new land, but then came a period of economic depression, which paralyzed all progress. With the forties came a fresh era of advance, evinced not only by a renewal of the efforts made to drain and cultivate new tracts, to the support of which efforts the State from that time forward began to make considerable grants, but also by the employment of new methods, such as subsoil draining and the employment of artificial manures, for the purpose of increasing the return made by the land, and by the creation of State-institutions and establishments for the promotion of agriculture, among which may be mentioned agricultural schools and high schools, agricultural meetings, central breeding-herds, the Geological Survey of Sweden, and the Central Bureau of Statistics to which the agricultural statistics were transferred.

Peasant farm-house, Eks in Hälsingland.

This period of progress was interrupted by the economic crisis which began towards the close of the fifties and the effects of which were felt during a great part of the following decade, but then came a new period marked by a vigorous development of agriculture, although on this occasion the efforts made took a somewhat different direction. At an earlier date farmers and agriculturists had already begun to pay attention to cattle-farming, and especially to improved methods of cattle-breeding. After a brief attempt to bring about a permanent export of store-cattle, the cattle-farming of the country was more and more directed towards milk-production and the manufacture of butter, of which a steadily increasing quantity was now exported to England every year. The direction thus taken by Swedish agriculture became still more marked when, during the eighties, a great increase in the import of grain from distant

countries and the consequent fall in the price of this product had resulted in a comparative diminution in the cultivation of grain crops.

It is true that the prices of grain, partly in consequence of the duties introduced in 1888, have risen, so that the cultivation of grain has once more become profitable, but the production of milk for butter-making purposes has, however, still retained its position as the farmer's principal permanent source of income, and attention is paid in the first place to the development of cattle into rich milk-producing stock. Very successful efforts have, however, been simultaneously made to increase the returns given by the arable land, and also to the production and export of cattle intended for consumption, of pork, and of meat. The increasing export of store-cattle met with a severe blow during the nineties by the import prohibition then issued by England, in order to prevent the spread of infectious cattle-diseases, regulations which have also been promulgated every now and then by Norway, Denmark, and Germany. During the last few years, however, since slaughter-houses began to be erected, the export of pork and meat has attained very considerable dimensions, and the export to Germany of living cattle, too, has also become a considerable source of income for Swedish farmers.

Peasant farm-houses, near the river Torne älv in Upper Norrland.

While, in Sweden as in most other countries of Europe, agricultural produce has become more and more unable to satisfy the increased demands of the population for the necessaries of life, the returns made by the land have considerably increased, especially during the last few decades. As far as the general position of agriculture is concerned, Sweden occupies a very prominent place, and the best developed Swedish agriculture does not suffer by a comparison with the best in any other country.

Various factors have contributed to this progress. Important auxiliaries, such

as artificial manures, concentrated foods, improved implements and machines, of many new descriptions and at cheaper prices, have come more and more generally employed. Scientific investigation has rendered ever-increasing services to agriculture. The State, too, has given its assistance, by the establishment and support of institutions the aim of which is to direct the development, to spread information, and to remove obstacles to the progress of agriculture.

During the last few years, too, there has been increased co-operation of the farmers themselves, the result of which has been that the supplies, not only of material auxiliary resources, but also of competent direction of production and of the sale of the produce, have been considerably facilitated, while, above all, interest in the progress, and in the knowledge of the various departments, of the industry, has extended to the great bulk of the farmers.

In consequence of the great extent of Sweden and of the great differences in respect to natural conditions and to means of communication, there still exist great dissimilarities between the various parts of the country, both as regards technics and the organization of agriculture, and the stand-point these have reached. Skåne and the neighbouring tracts of the Län of Halland are, nowadays, scarcely inferior to Denmark, whether as regards agriculture, live stock, or the dairy-industry. It is true that, in other parts of those divisions of Sweden that go by the name of Götaland and Svealand (the southerly and more central provinces), agriculture has not yet reached such a high stand-point, and that agriculture in Norrland has been still less able to avail itself of modern resources and methods, but vigorous efforts to secure such improvements in the agricultural industry may be noted just now in every part of Sweden.

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1. AGRICULTURE.

Dependence of agriculture on the natural features of the country.

The character of agriculture in general, but especially the nature of, and the results gained from, the cultivation of the soil, depend in an essential degree on the natural features of the country that prevail in each district, these being chiefly, the character of the soil, the amount and distribution of the precipitation, and the warmth of the atmosphere and its variations.

As regards the *soil*, the most prominent differences are those existing between the clayey plains of the lowlands and the sand- and gravel soils of the higher-lying land, and the marshy and boggy land distributed in both. In consequence of the comparatively greater wealth of mineral plant-food possessed by the clay-lands, and their ability to retain soluble the nutritive substances, these soils belong to the richest the country possesses, but the stiffness of this kind of soil, and its greater impenetrability to water, necessitates vigorous labouring and thorough draining. The great fertility of these districts, in combination with their greater need of working-capital for the tilling of the soil, has the result that the larger farms are principally to be found in those parts of Sweden where this clay soil predominates, i. e., the central and southern plains of the country. Sand and gravel soils, on the other hand, are poorer in easily accessible plant-food and are, therefore, often less fertile, although they are often very fruitful, especially those sand- and gravel

Old Scanian peasant farm-houses, Järstorp, Andrarum.

soils which extend over a great part of the north of Sweden and are rich in fine sand and silt. In consequence of their loose consistency, which gives easy access to the air, soils of this kind require less labouring and draining and are, therefore, more suitable than the stiffer ones for the small farmer who, as a rule, is less well provided with powerful implements for his work. Such soils as those now in question predominate both in the highlands of Småland and Västergötland, and over the greater part of Northern Sweden.

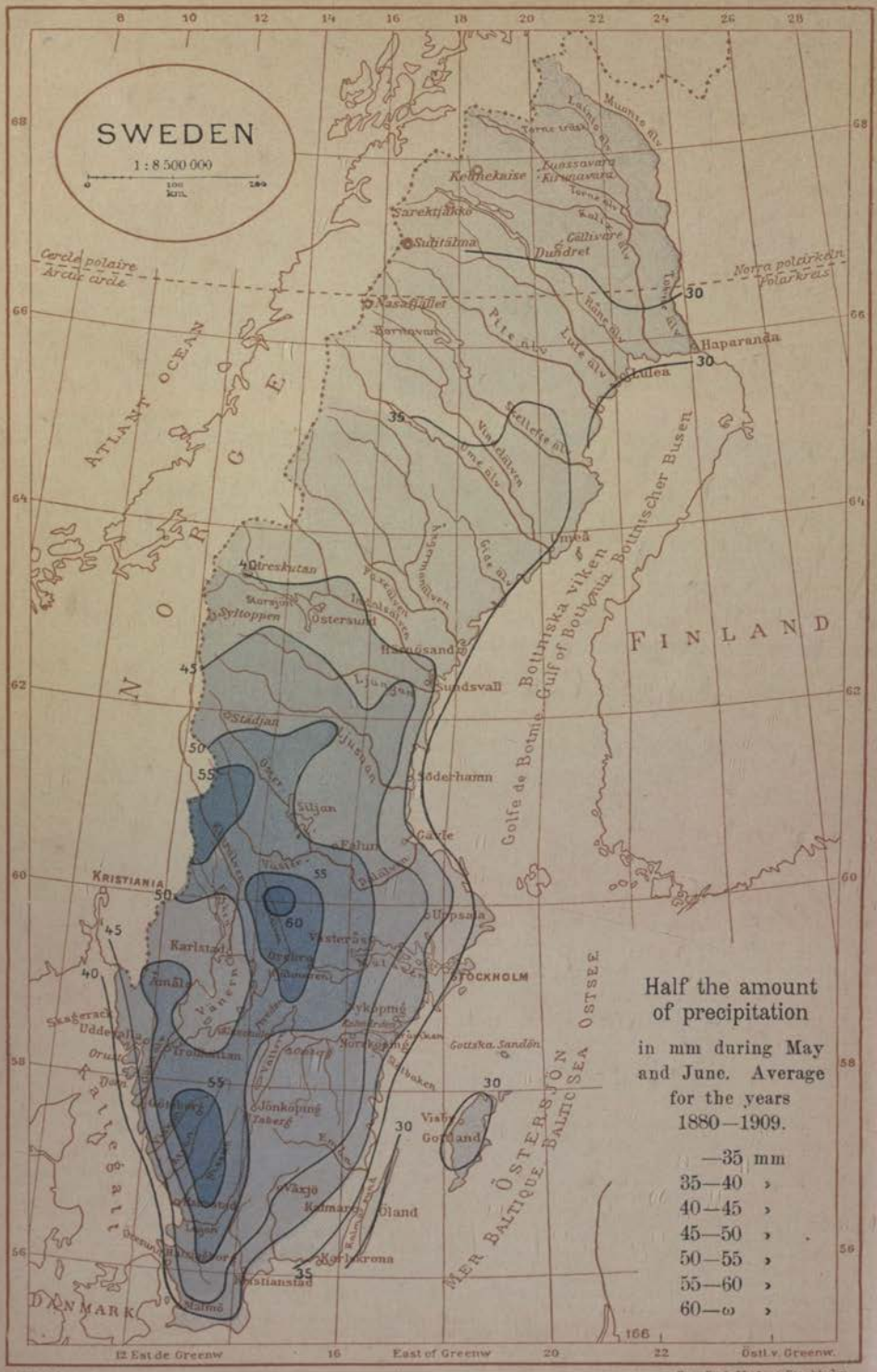
A third class of soil is that formed by the humus and peat of the swamps, fens, and bog-land. It is distinguished by the ease with which it is tilled, its great capability of retaining the moisture so necessary for growth, and by its wealth of nitrogen, the most valuable of all the elements necessary to the nutrition of the plants. These soils, which, to the same degree that their organic constituents decay into humus, are specially favourable for the growth of fodder plants, do not, like gravel and sand soils, or the clayey lands, predominate in certain parts of the country, but occur here and there both in the clay- and in the sand- and gravel districts. Where they are found to an extent which is large in proportion to the other arable land, such as in the Småland-Västergötland highlands and in Norrland, they contribute, to a certain degree at least, to give a character to the agriculture there carried on, being almost exclusively devoted to the production of cattle-fodder (oats, green fodder, and hay), while the cultivation of autumn grain (wheat and rye; i. e., breadcereals), which cannot be suitably pursued in such soils, becomes quite of secondary importance.

The *proportion of lime* contained by the soil has also great influence on the fertility of the land, so that those districts where the soil has a higher percentage of lime exceed in fertility neighbouring tracts where there is less lime. This is the case with the marl-districts (marl means soil rich in lime) of Skåne, Öland, Gottland, Östergötland, Västergötland, Närke, Uppland, Dalarne, and Jämtland, where the ground consists of easily crumbling limestone and clayey shales.

The varying percentage of the elements of plant-food contained by primitive rocks also influences the fertility of the land, so that, for example, if we take the district, as a whole, that extends from Värmland to North Skåne, where the rock consists of an iron-gneiss poor in plant-food, we find that it possesses a poorer soil than the granite districts of the eastern part of the country. This difference is seen more especially in the cases where the soil is of moraine gravel, consisting of chemically unaltered crushed rock; it is less marked, on the other hand, in the deposits of clay that have been washed out of the moraine. A result of this difference is that the cultivation of oats, a cereal which, as far as the fertility of the soil is concerned, is more easily satisfied than others, is found more extensively grown in the western parts of Svealand and Götaland than in the east. The very poorest tracts are those in Dalsland, Western Dalarne, and the high, mountainous districts of Norrland, where the soil derives its origin from sandstone, quartzites, and mica-schists.

As the development of plants depends largely on the presence of a sufficient amount of moisture in the earth during the period of growth, *the amount of rainfall* during the early summer and at midsummer, when the growing crops take up the principal amount of their nutritive substances, is determinative of the yield of the harvest; wet weather at the periods mentioned being, on the whole, most advantageous, while, on the other hand, dry weather during the latter part of the summer and during the autumn favour the getting in of the harvest, on the successful progress of which the character and value of the crops, and the labour-demand for the harvest-time largely depend. Unfortunately, the climate of Sweden, as far as regards the amount of precipitation, runs in quite a contrary direction in this respect; May and June are, as a rule, distinguished by a continuous drought, which hinders the growth of the plants and arrests the development of the crops, while, on

Modern Scanian peasant farm-house.


SWEDEN
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Cercle polaire
Arctic circle
Norra polcirkeln
Polarkreis
ATLANT OCEAN
NORGE
FINLAND
Bottniska viken
Golfe de Botnie
Gulf of Bothnia
Bottnischer Busen
ÖSTERSJÖN
MER BALTIQUE
BALTIC SEA
OSTSEE
DANMARK
Kattegatt
Kristiania
Stockholm
Haparanda
Lulea
Umeå
Sundsvall
Söderhamn
Gävle
Uppsala
Gotland
Öland
Karlskrona
Kristianstad
Malmö
Sulitälma
Dundret
Nasafjället
Sarektjåkko
Kebnekaise
Umeå
Ostersund
Östersund
Syltoppen
Stadjan
Siljan
Falun
Karlstad
Åmål
Trollhättan
Göteborg
Jönköping
Vänern
Vättern
Vaxjö
Kalmar
Visby
Gottska Sandön
Nykoping
Norrköping
Vasterås
Orebro
Gotland
Half the amount of precipitation in mm during May and June. Average for the years 1880—1909.
—35 mm
35—40 »
40—45 »
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12 Est de Greenw
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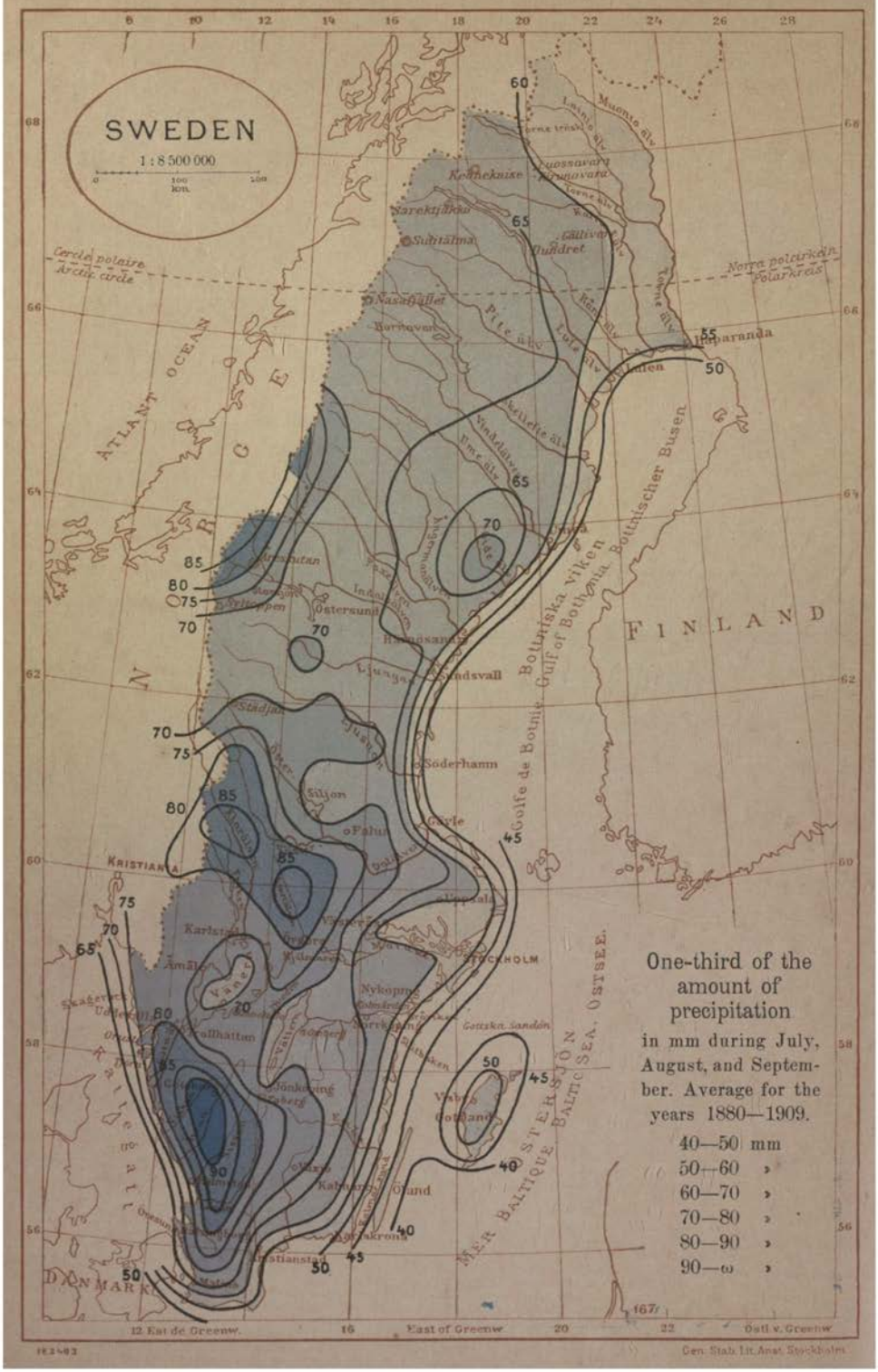
Östl. v. Greenw.
Gen. Stab. Lit. Anst. Stockholm

the other hand, the amount of moisture that falls during July and, more especially, during August, is, on an average, very great, rain often greatly delaying the getting in of the crops, increasing the harvest work, and injuring both the straw and the grain. The distribution of the rainfall is, however, different in different parts of the country. The highland districts of southern and central Sweden are, on the whole, richest in rain, even during the early summer; then comes the west coast, while the Baltic coast and the tracts adjacent to the great lakes have drier weather, especially during the early summer, a period of such importance for the year's growth. The inconvenience of rain during the harvest time is considerably diminished in the coast districts by the winds that prevail there, and, in consequence, the weather, both during the early summer and the latter part of this season, is more favourable on the west coast of the country than elsewhere in Sweden.

These circumstances explain, to a certain degree, the varying character of agriculture in Sweden in general and in its different districts. For example, the small rainfall during the early part of the summer is one of the reasons of the small returns given by the fodder-lands, and the disinclination shown to turn fields into meadows and permanent grass-lands, which demand a comparatively great amount of moisture. It is undoubtedly a result of the drier climate prevailing in the early summer along the eastern coasts of Central and Southern Sweden, and in the districts round Lake Mälaren, that wintercrops, which, comparatively, suffer less from the droughts of the early summer, are cultivated in the tracts mentioned to a greater degree than in the interior of the country and along the west coast, where the heavier rainfall in the summer favours the cultivation of spring cereals.

Finally, as regards the *warmth* of the air and of the earth, it is clear that this is a factor of great importance in the choice of the crops to be cultivated and in the returns that may be expected in a country with such a short period of growth as that prevailing in Sweden. On the whole, the average temperature is lower and the summer shorter the farther north and the higher above the sea a place is situated, but the relative position of a region to the sea occasions certain deviations from this general rule. For example, in consequence of the fact that land is warmed more quickly than water, the interior of the country is warmer than the coast districts during the spring and the early summer, and vegetable growth in the Baltic tracts, therefore, during this period of the year, has to combat against both drought and cold. During the middle of the summer, the temperature becomes equalized over the whole country, and from the latter part of August, thermal conditions become just the opposite to what they were during spring, the slower cooling-down of the water, as compared with that of the land, giving the coast districts a milder autumn climate than that enjoyed by the interior of the country. This condition of things is especially the case in Gottland, and it also contributes to make the cultivation of winter cereals important in the districts lying near the Baltic, as the power of resistance against the cold of winter possessed by these kinds of grain is favoured by long, mild autumns.

But, in certain parts of the country especially, the normal thermal conditions just mentioned are disturbed by sudden changes in the form of *night-frosts*, which can be injurious to vegetation. During the early part of the summer, a "frost-tract" extends from Skåne, across the Småland-Västergötland highlands, all the way to Northern Uppland, and within this district night-frosts during May and June injure the growing spring cereals, the sprouting root-crops and, especially, the winter rye during its susceptible blooming period. In Northern Sweden, on the other hand, the rapidly arriving spring is not, as a rule, disturbed by any night-frosts. In the latter part of the summer and in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MER BALTIQUE
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Gotland
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12 Est de Greenw.
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One-third of the amount of precipitation in mm during July, August, and September. Average for the years 1880—1909.
40—50 mm
50—60 »
60—70 »
70—80 »
80—90 »
90—ω »
Gen. Stab. Lit. Anst. Stockholm

the autumn, on the other hand, it is Norrland, as far south as to Northern Uppland, and the higher districts in the other parts of the country — the marshy tracts especially — that are exposed to early frosts which can arrest the development of the oats, meslin, and potatoes, prevent the ripening of the grain, and diminish the results of the harvest.

The drawbacks caused by these unfavourable thermal conditions of the weather can, however, be diminished by the choice of suitable crops for cultivation. The injurious effects of spring frosts, therefore, will be less where rye is replaced by wheat, which flowers later, and the cultivation of which has increased considerably in the clay-soil districts of Central Sweden, while the danger of autumn frosts compels the farmers of the highland districts and of Northern Sweden, where it is uncertain if the oats will ripen, to cultivate barley, which ripens earlier, and also, to cultivate green fodders and grass instead of ripe grain. In these tracts, therefore, the cultivation of grain becomes of lesser importance, cattle-farming becoming the chief, or, as in the most northerly parts of Sweden, the only object of attention.

Communications and *markets* have a great influence on the character of agriculture in various parts of the country. As a general rule, it may be said that good communications and easy access to markets produce greater intensity in the agricultural industry. This is shown especially in Skåne, with its dense net of railways, many harbours, and numerous towns and other centres of population, and where, too, the favourable conditions of climate contribute to induce great activity in the cultivation of the soil and in cattle-farming. But in the more northerly parts of the country, too, where climatic conditions are less favourable, corresponding conditions show their influence, and in the neighbourhood of every large town or centre of population there arises, as a rule, a district where a great part of the land is devoted to gardening and to an advanced cattle-farming especially directed to the production and sale of milk.

Number and dimensions of Farms.

The farming land of Sweden, according to the official statistics for 1911, was distributed among 359 871 estates, the average cultivated extent of each of which was nearly 10 hectares, although the size of the various farms varied very considerably. Of the size-groups into which the landed estates were divided in the official statistics

those possessing	up to 2	hectares	cultivated	ground	embraced	about 25 %
" "	from 2—20	"	"	"	"	" 64 %
" "	" 20—100	"	"	"	"	" 10 %
" "	above 100	"	"	"	"	" 1 %

of the total number of farms.

It will be seen that the small farms form by far the greater *number* of the whole, and this would appear still more clearly if the farms were divided into groups the difference between which was only 1 hectare, as farms with not more than 1 hectare of cultivated ground form the greater number, or about 50 000, the numbers in the succeeding groups declining with considerable regularity with the increasing area of cultivated land. But taking 10 hectares as the limit of the area that can be managed by the owner without the assistance of hired labour, about 70 % of the total number of farms would consist of such small holdings.

From a calculation showing how the cultivated land of the country is distributed among the different size-groups it has been deduced that small farms of not more than 10 hectares of arable land, and large ones of more than 50 hectares,

each occupy about $^1/_4$ of the total of the cultivated area of Sweden, the rest, or about $^1/_2$, being distributed among farms with from 10 to 50 hectares of arable land.

The way in which the land is distributed varies greatly, however, in different parts of the country. It has already been pointed out that on the open plains of Sweden, with fertile clay-soils, large estates are comparatively numerous, while the greatest number of the small farms is to be found in the highland districts or the hilly tracts, where the soil is of a lighter character and is broken by hills, forests, bogs, and other irreclaimable land. For example, the land in the Mälaren districts and in the plains of Östergötland and Västergötland is occupied for the most part by large estates and large and medium-sized peasant-farms, while small farms of less than 20 hectares are incomparably most numerous in Småland, Dalarne, and Norrland. In the neighbourhood of large towns and industrial centres, where there are plenty of other occupations besides farming, there have grown up, especially during the last few years, numerous independent farms of such limited areas that they could not of themselves possibly support their owners, being often little larger than building-plots.

While, in previous years, the number of large estates increased by small farms being bought up, there has arisen during the last few decades a contrary tendency to split up the large estates for the purpose of forming small farms and especially small holdings (Sw. småbruk). This development has been made possible by the increasing removal of the obstacles that legislation previously placed in the way of the cutting up of the large landed estates into farms whose area was below the limits of support for a family (besutenhet) and of capability of paying taxes, and also by the creation of a new and convenient legal form of cutting up estates, called "estate-dismemberment" (Sw. ägostyckning). But, in addition to this, the formation of small holdings has been promoted directly by the dismemberment and sale of Crown domains, the letting out of small holdings on lease from the Crown forests (Forest holdings; Sw. skogstorp) and by the granting of public means to form loan-funds for the purpose of assisting the "own home" movement. In Norrland, on the other hand, there was still continued, in connection with the development of the lumber trade, the throwing of the farms into large estates, the saw- mill companies buying farms with forest-land, in order to dispose of the timber, the cultivated ground being usually leased to the former owner, or, in many cases, afforested. It was especially in order to prevent the disappearance of the independent peasant that the said enactment — "the estate dismemberment procedure" (Sw. ägostyckningsförfarandet), — was passed, according to which forest land can be sold from the farm separately from the farming land; but as this led to the creation of farms which possessed no timber for home use, a state of things which, in Norrland, is considered as being ruinous to agriculture, the estate dismemberment procedure in Norrland has been suspended and a prohibition has been issued against the sawmill-owners purchasing landed estates (see the section concerning Agricultural Legislation: the Norrland Enactments).

One favourable circumstance is that, as a rule, the Swedish farms are in the hands of the owners themselves. Of the total number of farms in 1911, only a little more than 14 % were *leased*; a very small number of the farms of the smaller classes especially (10 and 13 %, respectively) are held on leases, but of the larger estates, with a cultivated area exceeding 20 and 100 hectares of cultivated ground, greater proportions (31 and 35 %) are let out on lease. It is especially such land that is let on lease as, in consequence of its distant situation, is inconvenient for the owner himself to farm, or as is owned by persons who devote themselves to other occupations than agriculture. Farms held on lease are more numerous, therefore, in connection with the larger estates, especially such as belong to ironworks or sawmills.

TABLE 9. *The Distribution of the Area of Cultivated Land by Läns, in 1911.*

Län	Entire land area [2] Sq. km	Whereof in sq. kilometers: cultivated land	natural meadow	woods	other land	In % of area: cultivated land	meadow	woods	other land
Stockholm [1]	7 474	1 679	294	4 104	1 397	22·5	3·9	54·9	18·7
Uppsala	5 121	1 573	287	2 727	534	30·7	5·6	53·3	10·4
Södermanland	6 237	1 773	138	3 992	334	28·4	2·2	64·0	5·4
Östergötland	9 968	2 492	597	6 079	800	25·0	6·0	61·0	8·0
Jönköping	10 617	1 399	986	5 759	2 473	13·2	9·3	54·2	23·3
Kronoberg	8 906	925	910	2 654	4 417	10·4	10·2	29·8	49·6
Kalmar	10 961	1 795	592	6 482	2 092	16·4	5·4	59·1	19·1
Gottland	3 118	712	165	1 419	822	22·8	5·3	45·5	26·4
Blekinge	2 896	652	147	1 164	933	22·5	5·1	40·2	32·2
Kristianstad	6 222	2 502	389	2 535	796	40·2	6·3	40·7	12·8
Malmöhus	4 729	3 502	158	449	620	74·1	3·3	9·5	13·1
Halland	4 771	1 382	277	848	2 264	29·0	5·8	17·8	47·4
Göteborg och Bohus	4 897	1 006	115	1 294	2 482	20·6	2·3	26·4	50·7
Älvsborg	11 678	2 203	525	7 196	1 754	18·9	4·5	61·6	15·0
Skaraborg	8 075	3 452	283	3 076	1 264	42·7	3·5	38·1	15·7
Värmland	17 549	2 048	451	13 632	1 418	11·6	2·6	77·7	8·1
Örebro	8 318	1 566	292	5 355	1 105	18·8	3·5	64·4	13·3
Västmanland	6 436	1 544	215	3 505	1 172	24·0	3·3	54·5	18·2
Kopparberg	28 150	1 043	958	20 719	5 430	3·7	3·4	73·6	19·3
Gävleborg	18 314	1 023	779	14 944	1 568	5·6	4·2	81·6	8·6
Västernorrland	24 128	854	483	19 921	2 870	3·5	2·0	82·6	11·9
Jämtland	47 512	578	385	29 187	17 362	1·2	0·8	61·4	36·6
Västerbotten	55 769	920	1 800	27 500	25 549	1·7	3·2	49·3	45·8
Norrbotten	99 166	383	1 830	29 241	67 712	0·4	1·8	29·4	68·4
The whole Kingdom	411 012	37 006	13 056	213 782	147 168	9·0	3·2	52·0	35·8

[1] Stockholm city and län. — [2] Cf. Table 1, Part I with more recent figures.

The figures showing the number of farms does not include *crofters' allotments* and other non-independent holdings, the number of which amounted in 1911 to 138 677. The crofter-system has on good soils been considered as a form of agricultural employment for farm-labourers which is extremely favourable both for the landowner and for the crofter, but it has been falling out of use ever since the middle of the 19th century. At first the crofters' holdings were thrown into the mother-estate again, in consequence of the growing opinion that the land would give greater returns if it was cultivated together with the rest of the estate. During the last few decades, it has become necessary to do this more and more, in consequence of the difficulty experienced in finding labourers willing to pay for their holdings in days' work, and no difference has been caused in this respect by the decided improvement in the position of the crofter brought about by the new Tenants Act of June 14, 1907. Crofters' holdings, therefore, are being more and more turned into farms held on ordinary leases, with the rent payable in money, in such cases where the land is not again thrown into the mother-estate.

The extent of cultivated ground

in Sweden at the present day is shown by Table 9. More precisely stated, it amounted in 1911 to 3 700 644 hectares, of which 45 719 hectares were garden land and 3 654 925 hectares farmed land. In addition to this, there were 1 305 698 hectares of natural meadow-land, so that, with the inclusion of

this, the total area of land employed in agriculture in Sweden amounts to somewhat more than 5 million hectares.

The extent of cultivated land alone (that is, apart from the natural meadow-land) amounts to 9·0 % of the total area of the country, but the variations even between the different läns are enormous, as shown by Table 9, no less than 74·1 % of the area of Malmöhus Län being under cultivation, while of the vast Norrbotten Län, only 0·4 % is farmed. Still greater differences appear in smaller districts, as is shown by the map on p. 45. In the most northerly hundred (Sw. härad) of Sweden, the cultivated land scarcely exceeds one tenthousandth part of the total area; in the most southerly hundreds, on the other hand, it amounts to 90 % and more.

The figures showing the amount of arable land in Sweden in earlier times are very unreliable, but it is not improbable that, during the 19th century, this area has been *quadrupled*. Neither are reliable figures to be had for the amount of fresh land taken into cultivation during the last few decades, but although, according to the statistics available, the annual increase in the area of cultivated land has, it is true, fallen by some 30 000 or 40 000 hectares — these being the figures for the middle of the nineties — to about 10 000 hectares during the last few years, even these last figures bear witness to the fact that the desire to cultivate new land still exists, in spite of the increased price of labour. Part of the reclaimed land has been taken from the area of natural meadow, but much has been gained from forest-land or from land previously lying waste, especially by the draining of low-lying districts, the cultivation of moorland, and by the tapping of lakes. During the last few years, the State has made fairly large grants for cultivation purposes; an account of this is given in a special section farther on. A special account is also given below of the work carried on by the Swedish Moor Culture Association.

The distribution of cultivated land with respect to the chief crops produced, to the amount of fallow-land, and to the changes in these respects during about half a century, is shown by the following figures for 1865 and 1911:

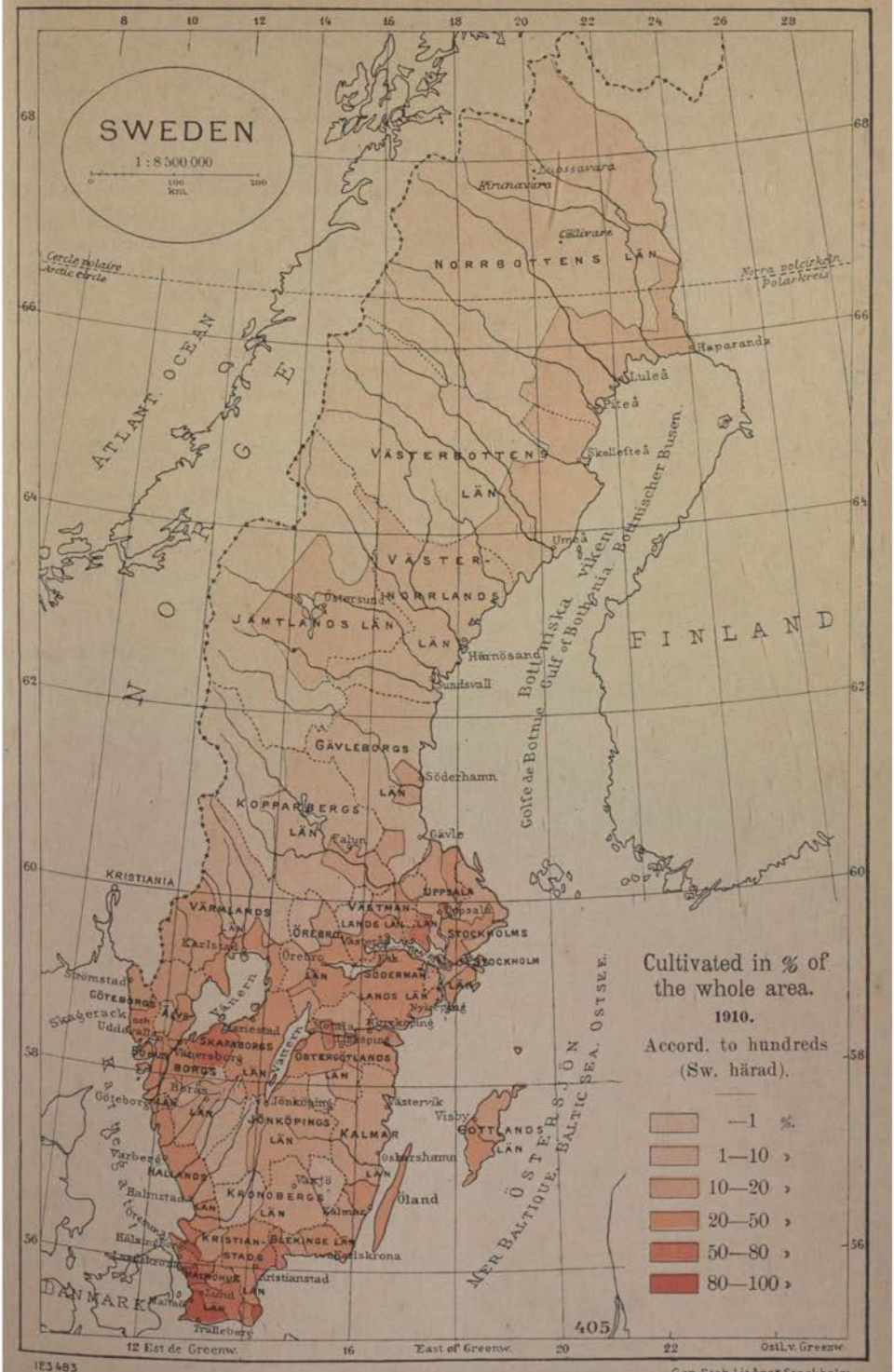
	1865 hectares	1911 hectares	1865 %	1911 %
Cereals	1 177 000	1 676 000	50·5	45 9
Fodder plants; hay, green fodder, seeds	635 000	1 358 000	27·2	37·1
Root-crops	135 000	257 000	5·8	7·0
Other crops	21 000	3 000	0·9	0·1
Fallow-land	365 000	361 000	15·6	9·9
Total	**2 333 000**	**3 655 000**	**100·0**	**100·0**

These figures, which are probably too low for 1865, have regard to farmed land. In order to obtain the total area of land under cultivation there should be added to the two totals of hectares of land the area of the garden-land, which in 1865 amounted to about 21 000 hectares and in 1911 to 45 719 hectares.

The cultivation of farmed lands.

Contemporaneously with the increase in the area of the cultivated land, its returns have also been steadily advancing (Table 12). This is the result of the soil-improvements, the increased and more appropriate use of manures, and the more thorough tillage of the arable land adapted to the varying conditions.

Among the improvements of the land, *draining* is the most important. It makes it possible for plant-roots to penetrate deeper into the earth, by which



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they find access to an increased amount of nutritive materials and obtain protection from drought, which, in Sweden, is one of the chief causes of poor harvests. Draining has also the further result that the soil dries more quickly in the spring and after heavy rains, this making it possible to begin tilling and sowing earlier than can be done on land that is not so well drained. Draining, however, is still much neglected, and over the greater part of the country there exist merely, or for the most part, shallow, open ditches. It is impossible for such ditches to attain a depth sufficient for a satisfactory draining of the land without great inconveniences, the chief being that they occupy too large a proportion of the fields, while they are extremely expensive to keep in order. Under-draining, therefore, is the only means of drying up the land in a fully satisfactory way. This method was first introduced into Sweden in the forties and during the sixties and the following decade, it was employed very extensively, but the decline in available labour and the consequent rise in wages have placed difficulties in the way of carrying out this improvement. Under-draining is most general in the southernmost läns of the country and then in Östergötland; in the other parts of Southern and Central Sweden it is chiefly employed on manor-farms, while in Norrland it is met with only exceptionally. When under-draining is carried out by the peasantry, it is all too often of little efficacy and durability, the drains being made too shallow and being filled with stones or laths, this resulting in a small draining-power, which soon ceases altogether.

An effective method of increasing the fertility of the land is, in many cases, the mixing of the natural soil with earth possessing opposite qualities, hard-worked earth thus being made porous, while loose soils are given increased consistency and higher conducting capacity for heat and moisture. Among such methods of improving the soil there is employed pretty generally, especially in the north of the country, the addition of humous soil or peat for land that is hard or poor in humus, while moor- and bog-land is improved by the addition of sand, gravel, or clay (Sw. sandkörning; lerslagning), which makes the soils in question firmer and warmer, and renders them less susceptible to frost, at the same time increasing their originally poor supply of mineral constituents.

On the whole, however, the improvement of land by soil mixture has declined, in consequence of the great cost it entails. This holds good of the "*marling-process*" especially (i. e., the addition of marl, or soil rich in lime). This method of improving the land was employed very generally in Skåne from 1840 to 1870, and to a still later date in Southern Halland, and is considered to have contributed greatly to the increased fertility of the soil in these parts of Sweden; but, on the other hand, it has been but little employed in other parts of the country and is now rarely made use of. The chief reason for this, most probably, is that "marling" necessitates considerably more labour than the addition to the soil of lime in more concentrated forms of chalk, such as slaked lime, ground lime (or limestone flour, agricultural- or manuring-lime, as it is called). These latter forms of limestone are employed especially in the cultivation of moor lands, the acid character of which must be neutralized, if the soil is to be made fully productive.

But the increased fertility of the land is, probably, chiefly the result of a more thorough manuring of the soil, carried on after more correct principles. More than half a century has now elapsed since artificial manures began to be used in increasing quantities and of varying kinds; first, bone-dust was used then, from the forties, guano, followed in the order given by super-phosphate, nitrate of soda, sulphate of ammonia, potash, Thomas-phosphate, and finally, by nitro-carbide. At first, the confidence placed in the new and convenient manures seems to have brought about a certain neglect of the natural animal-manures; but, during the last few decades, not only has the great progress made in cattle-

farming given considerably increased quantities of this, the most important, means of maintain the fertility of the land, but great care, too, has begun to be paid to its storage and scientific employment. Chemical and bacteriological investigations, together with very extensive series of experiments, have been made for the purpose of throwing light on this question, and have succeeded in arousing a more general interest among farmers for rational methods of manuring, and a knowledge of the way in which the work should be carried out.

As regards *tillage*, too, a decided improvement is to be noted. The arable land is ploughed more deeply, this giving the plant-roots access to a larger food-supply area, and to a more equable store of moisture. There is also to be noticed a more general endeavour to prevent the soil from losing its humidity, this being done by the employment of suitable methods of treatment for diminishing the surface evaporation, while, at the same time, the ascent of water towards the surface from the subsoil is facilitated. Success in this direction has been rendered possible by improved implements specially suited for the purpose, the rise of a very flourishing home manufacture of agricultural implements (see p. 73) having largely contributed to this end.

While agricultural technics have thus been improved, the arrangements adopted for the cultivation of the various crops have been developed to a higher degree of intensity. The *old course of grain crops*, in accordance with which the fields were divided into 2—4 parts, one of which lay fallow while the others were employed for the production of crops, was necessitated by the way in which the land was formerly divided among the farmers, each field in a village community being divided among all the landowners in the village (see pp. 28 foll.), but by degrees, as the "Separate-re-partition" and the "Legal re-partition" systems were carried into effect, the farmers began to employ a more productive system of agriculture. As long as the cultivation of grain was the chief source of income for the farmer, the great bulk of the farmers of the country were slow to adopt a more intensive course of crops, and even as late as the sixties, when annual statistics began to be drawn up, two-course or three-course rotations were predominant, the former in the provinces around Lake Mälaren, the latter in Götaland. But when greater importance began to be attached to cattle-farming, necessitating the cultivation of fodder on the farmer's land, the transition to a more intensive system became more general. The rotation ordinarily adopted was that called "grain-ley rotation" (Sw. sädes-vallbruk), often called "couple-rotation" (koppelbruk), extending over 7 years, in which the fallow-land, which has been manured with farmyard-manure, is sown with autumn-seed, in which grass is afterwards sown, which, after 3 years, is broken up to make way for oats during 2 years. For several reasons, but especially in consequence of the too long intervals between the manurings, and the small opportunity that is given for a thorough labouring of the land, such a course yields too small crops to satisfy the demands of the farmers of to-day, and, consequently, in places where agriculture is carried to a high degree of perfection, has been changed to a more complete variation of crops. The chief features of such regular *rotation of crops* are: the cultivation each year of a different kind of crop — ripe grain, green-fodder, root-crops — manuring, if possible, before each crop and in accordance with its special requirements, and a frequently recurring thorough labouring of the soil, together with measures for the arrest of the growth of weeds. This development is specially shown by an increasing cultivation of root crops, not only in consequence of the latter being able to yield greater harvest-value than any other kind of plants cultivated in Sweden, but also because these crops, in consequence of their demand for vigorous manuring, thorough tillage, and the freeing of the land from weeds, necessitate a higher standard of agriculture, thus occasioning better returns from other classes of crops, too.

Example of Swedish "couple-rotation"	Ordinary rotation
1. Fallow	Green fodder.
2. Winter grain	Winter grain.
3. Ley	Root crop.
4. »	Barley.
5. »	Ley.
6. Oats	Oats.
7. »	

The cultivation of cereals.

The progress made by agriculture in Sweden has, during the whole of the 19th century, been shown by the increase of the area devoted to the cereals, simultaneously with the increased cultivation of potatoes, and during the latter part of the century especially, of fodder plants, too. At the beginning of the 19th century, it is calculated that the area devoted to cereals amounted to about 500 000 hectares, but these figures rest on very unreliable statistics. In the middle of the sixties, when agricultural statistics began to be published annually, this area had increased to 1 200 000 hectares, a figure which, at the close of the century, had increased to a little more than 1 700 000 hectares. During the latter part of the 19th century, this increase in the area devoted to the cultivation of cereals had fallen off still more proportionately than the amount of the area of cultivated land in general had increased, so that, from the first decade of the present century, the cereal-producing land had declined to about 1 676 000 hectares in 1911, while the cultivation of fodder-plants, on the other hand, had increased (Table 10).

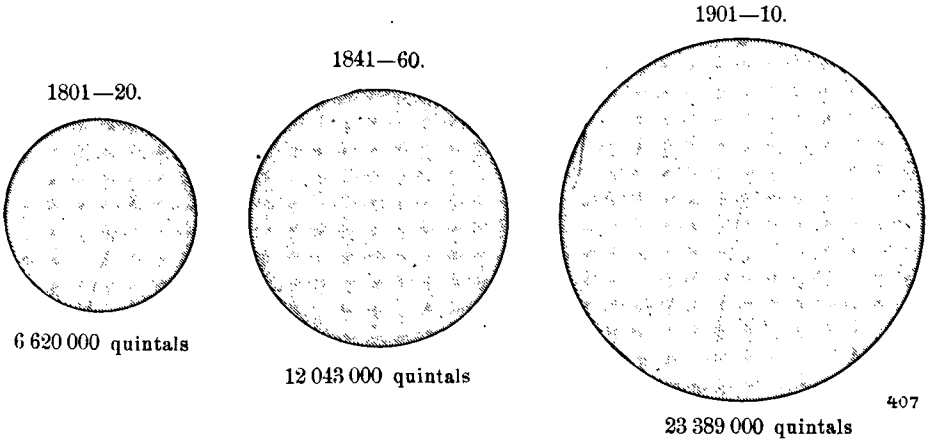
On the other hand, *the cereal crops,* as a whole, have continued to increase until the present time. From 6·2 million quintals, the estimated amount of the total cereal crop at the beginning of the 19th century, it has risen to 25 million quintals during the first years of the present century, i. e., it has risen in a somewhat greater proportion than the total area of the cultivated land, and especially as an ever-increasing amount of the latter has been employed for the cultivation of potatoes, root-crops, and other fodder-plants, the crops of cereals per area-unit has risen very considerably, or from an average of 11 quintals

TABLE 10. *Area devoted to the Cultivation of Cereals.* Hectares.

Annually	Total	Wheat	Rye	Barley	Oats	Meslin	Leguminous crops
1801—20	**552 150**	15 150	180 000	161 000	113 500	57 500	25 000
1821—40	**724 300**	21 800	236 000	187 500	152 000	82 000	45 000
1841—60	**911 000**	33 250	292 500	210 000	226 500	93 750	55 000
1861—80	**1 289 926**	58 243	355 051	225 196	516 053	80 383	55 000
1881—90	**1 565 992**	72 899	380 665	225 517	734 956	95 465	56 490
1891—00	**1 687 765**	72 580	405 268	219 736	819 381	119 932	50 868
1901—05	**1 710 187**	81 226	410 791	213 552	824 693	136 895	43 030
1906—10	**1 689 984**	91 578	405 542	192 637	804 194	155 081	40 952
1911	**1 676 314**	101 477	400 140	180 537	789 862	163 435	40 863

Note. Figures after 1911, as being preliminary, are not given here.

Total Cereal Crops, yearly averages.



per hectare at the beginning of the 19th century, to 15 quintals during 1906—10. This increase has, too, been a very regular one, declining only during the decade 1861—70 and the quinquennial period 1901—05, this decline in each case being due to the small yields — bordering on almost total failure of the crops — that occurred in two years in each period.

If the cereal crop per hectare be taken as a measure of the standard of agriculture, it will be shown that, when compared with other countries (Table 13), Sweden, with an average crop during the years 1901—10 of 13·6 quintals of wheat, rye, barley, and oats, is, in this respect, considerably above the

Proportional Crops of the Four Principal Cereals. By weight.

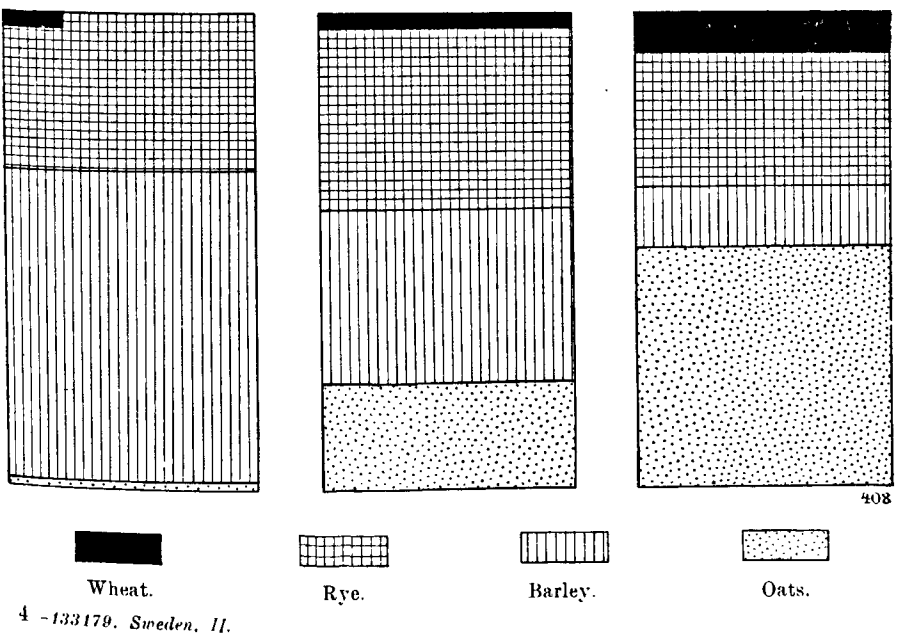


TABLE 11. *Crops of the various Cereals.* Quintals.

Annually	Total	Wheat	Rye	Barley	Oats	Meslin	Leguminous crops
1801—10 . .	[1] **6 207 000**	162 000	1 950 000	2 000 000	1 200 000	640 000	[1] 255 000
1811—20 . .	[1] **6 918 000**	198 000	2 240 000	2 200 000	1 300 000	700 000	[1] 280 000
1821—30 . .	[1] **8 132 000**	300 000	2 800 000	2 300 000	1 400 000	842 000	[1] 490 000
1831—40 . .	[1] **8 644 000**	350 000	3 150 000	2 250 000	1 550 000	869 000	[1] 475 000
1841—50 . .	[1] **10 290 000**	430 000	3 470 000	2 700 000	1 940 000	1 100 000	[1] 650 000
1851—60 . .	[1] **13 545 000**	620 000	4 550 000	3 080 000	3 480 000	1 185 000	[1] 630 000
1861—70 . .	[1] **15 400 000**	700 000	4 550 000	3 000 000	5 600 000	1 010 000	[1] 540 000
1871—80 . .	**18 926 024**	914 000	4 952 000	3 417 540	7 736 320	1 139 310	766 854
1881—90 . .	**21 382 170**	1 018 000	5 267 000	3 361 550	9 604 670	1 401 150	729 800
1891—00 . .	**23 429 000**	1 233 000	5 806 000	3 145 000	10 748 000	1 843 000	654 000
1901—05 . .	**21 385 866**	1 361 774	5 550 367	2 829 588	9 263 649	1 959 024	421 464
1906—10 . .	**25 392 030**	1 918 903	5 938 652	2 996 291	11 232 282	2 769 511	536 391
1911	**24 778 031**	2 178 439	5 929 490	2 894 012	10 395 400	2 843 941	536 749
1912	**27 519 900**	2 122 060	5 861 480	3 082 150	12 739 260	3 200 440	514 510
1913	**30 712 330**	2 539 180	5 655 830	3 682 110	14 488 290	3 810 900	536 020

[1] There are no figures for vetches.

average for Europe (10·1 quintals per hectare); this is especially true for comparison with the Latin and Slav nations, while in the case of the other Germanic countries the comparison goes against Sweden.

The differences that exist in respect to the cultivation of cereals within the various parts of Sweden, a country of such great extent and variations in the character of the land, are very great, however, whether we regard the proportions they bear of the total cereal-crops of the country or the returns per area-unit (Table 10). The first place in both respects is taken by Malmöhus Län, which, with a little more than one-tenth of the cerealproducing land of the country, yields a larger and more even harvest than any other län in Sweden. It alone produces more than one-third of the wheat, and about one-quarter of the barley and the meslin which is harvested in the country. As regards the return per hectare, it approaches the most productive countries of Europe. Among the other more important cereal-producing parts of the

TABLE 12. *Crops of Cereals in quintals per hectare.*

Annually	Wheat	Rye	Barley	Oats	Meslin	Leguminous crops
1801—10	11·5	11·3	13·1	11·0	11·9	14·2
1811—20	12·2	11·9	13·0	11·0	11·5	13·5
1821—30	15·0	12·4	12·5	9·7	10·5	14·0
1831—40	14·8	12·7	11·8	9·7	10·3	13·8
1841—50	15·4	13·0	13·5	10·7	12·2	16·2
1851—60	16·1	14·3	14·0	12·8	12·2	14·0
1861—70	13·6	13·0	13·8	12·6	12·5	13·0
1871—80	14·0	13·8	14·7	13·2	14·3	14·9
1881—90	13·9	13·8	14·9	13·1	14·7	12·9
1891—00	17·1	14·3	14·3	13·1	15·4	12·9
1901—05	16·8	13·5	13·3	11·2	14·3	9·8
1906—10	21·0	14·6	15·6	14·0	17·9	13·1
1911	21·5	14·8	16·0	13·2	17·4	13·1
1913 (preliminary)	20·9	15·4	21·6	17·8	21·4	13·8

TABLE 13. *Harvests in Different Countries, 1901—10.*[1]

	All kinds of grain[2]			Harvest in quintals per hectare				Potatoes
	thousands of hectares	harvest, thousands of quintals	quintals per hectare	wheat and spelt	rye	barley	oats	quintals per hectare
Belgium	706	16 446	23·3	25·6	21·7	27·3	24·1	160·1
Holland	445	8 814	19·8	22·4	16·7	26·0	22·0	132·2
Great Britain & Ireland	3 191	61 040	19·1	21·4	17·6	19·1	18·4	135·0
Denmark	971	17 863	18·4	27·8	17·3	20·7	16·9	124·5
German Empire	13 866	245 329	17·7	19·6	16·3	19·0	18·3	135·1
Norway	158	2 457	15·6	15·9	16·0	17·7	14·7	144·3
Sweden	1 511	20 548	13·6	18·8	14·1	14·4	12·6	96·6
France	12 932	164 507	12·7	13·6	10·6	12·9	12·0	84·6
Hungary	9 743	121 157	12·4	11·9	11·1	12·2	10·7	77·1
Austria	6 431	78 745	12·2	12·8	12·4	13·5	10·9	104·0
Rumania	4 916	52 118	10·6	11·8	8·8	9·6	8·5	31·4
Italy	6 785	69 410	10·2	9·1	—	—	—	—
Bulgaria	2 120	20 712	9·8	10·1	9·5	10·3	7·9	39·0
Spain	6 846	65 131	9·5	9·0	8·2	10·9	7·7	—
Servia	1 157	10 395	9·0	8·7	6·5	8·1	5·5	32·3
Russia in Europe	79 008	568 187	7·2	6·7	7·2	7·9	7·3	68·8
Europe	148 669	1 502 212	10·1	9·6	9·2	16·1	10·7	—
Canada	5 762	76 985	13·4	13·1	—	16·1	13·2	—
U. S. A.	73 465	990 732	[3] 13·5	9·6	9·9	13·8	10·6	62·3

[1] According to "Annuaire international de statistique agricole de l'institut international d'agriculture". Rome 1912. — [2] Wheat, rye, barley, oats, maize. — [3] The high general figures for the harvest of the U. S. A. are due to the maize, which yielded 16·4 quintals per hectare.

country may be also mentioned Kristianstad Län and the plains surrounding the great lakes of Central Sweden, together with Gottland and Öland, although, as regards the crops per area-unit, the regions mentioned do little more than just exceed the average for the country. In this respect, on the other hand, the Läns of Gävleborg and Kopparberg occupy a prominent place in spite of their comparatively northerly position, the explanation of this fact probably being in an essential degree due to their abundant supplies of manure and the very careful attention paid to its conservation, shown especially by its mixture with peat- and humous-earth, which has been universally used in these districts from very early times. But, in other respects too, agriculture in both these läns has, from early times, occupied a comparatively high position. If we except these two läns, the highlands and forest-lands of the country are below the average of the cultivated plains of Sweden, both as regards the area producing cereals and as regards the relative amount of the cereal-harvests.

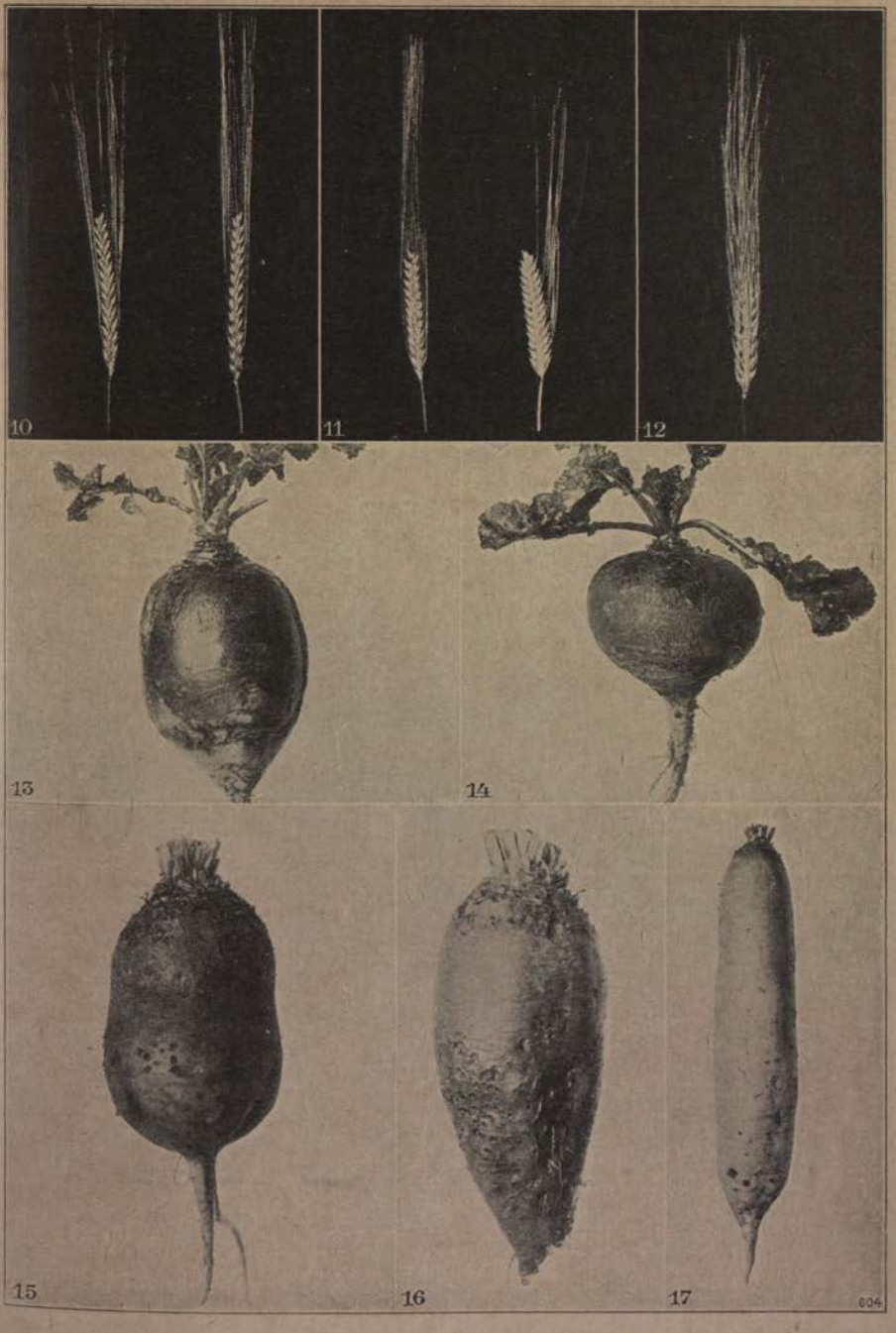
The share of the various kinds of cereals in the harvests of the country has, during the course of time, undergone considerable change, as may be seen by Table 11 and the diagram p. 49, below[1].

In earlier times, barley was the grain that was most cultivated in Sweden, but it has gradually become of lesser importance, so that, at the present day, only a comparatively small area of cultivated ground is devoted to this cereal, with the exception only of Upper Norrland where its earlier ripening gives it an advantage over other kinds of grain. In extensive tracts of the four northern-

[1] Calculated according to *weight*. In 1560 according to H. Forsell's calculations, which do not embrace the provinces which, at that date, belonged to Denmark or Norway, otherwise the place occupied by the wheat would be a somewhat more prominent one.

Cereals.

1. Svalöv Extra Squarehead wheat.
2. Swedish common wheat.
3. Club wheat.
4. Svalöv Star-rye.
5. Tartarian oats.
6. Svalöv Victory oats.
7. Mesdag oats.
8. Svalöv improved black clock oats.
9. Common Swedish black oats.



Cereals and Root-crops.

10. Svalöv Princess- and Chevaller-barley.
11. Imperial and Plumage barley.
12. Four-rowed barley.
13. Danish Bangholm swede.
14. Swedish greentop swede.
15. Eckendorf beet root.
16. Svalöv halflong Barres beet root.
17. Bortfeld turnip.

most läns, barley is the only kind of cereal that can be cultivated with any great degree of probability of a harvest of ripe grain. As a grain for bread-stuffs, barley has been replaced chiefly by rye which, at the beginning of the 19th century, was comparable as regards the total amount of the crop with barley, but which, at the close of the century, yielded about twice the amount of the last-named cereal; the cultivation of rye, however, has not increased in the same proportion as the cultivation of cereals as a whole; while, on the other hand, wheat, especially during the last few decades, has had an ever-increasing proportion of the cultivated land devoted to its growth, although it still occupies the last place amongst the four kinds of cereals, both as regards area and the share it bears in the entire cereal crop of the country.

The increase of the cereal crops depends, above all, on the vigorous advance of oat-growing. After having in earlier times been cultivated practically exclusively on temporarily ploughed meadow-land, this kind of grain has come to occupy an ever-increasing share of the cultivated land of the country and, at the present time, is grown on little less than half the total grain-producing area of the kingdom and yields almost as large a harvest as the other three above-mentioned cereals together, apart from the circumstance that, as a rule, it forms by far the greater proportion of the meslin, which, during the last few decades, has been cultivated to an ever-increasing extent.

Of lesser importance as regards the area under cultivation and the value of the harvest are the various kinds of leguminous plants (peas, beans, and vetches), and buck-wheat, which last-named grain has been cultivated on a gradually diminishing scale in the same proportion that agriculture in Sweden has improved, so that it is only grown now in the poorest sandy soils of Skåne, and that only on a small scale.

The crops yielded by the different kinds of grain at various epochs is shown by Tables 11 and 12, and, in accordance with the present division of the country into läns, by Table 16. Taken as a whole, Sweden can be said to be divided into three **regions** as regards the cultivation of grain. In Norrland, barley is the principal cereal and that to a higher degree the farther north we go. Central and Southern Sweden, on the other hand, can be divided into an eastern half, where rye-culture is prominent, and a western half, where the cultivation of oats is a still more distinguishing feature, the explanation of this phenomenon being the differences in the soil and climate of the country (cf. pp. 35 foll.). An idea of these conditions is given by the accompanying maps.

The increase in the production of cereals in Sweden has not only been important in itself, but it has even risen in a greater proportion than the increase in the population; during the century that has just come to an end, it is calculated, as was shown above, that the cereal-harvest has been quadrupled, while the number of the population has not more than doubled. But in spite of the fact that, calculated per head of the population, the crops may thus be estimated to have increased from 272 kg at the beginning of the 19th century to 475 kg at the present day — of which amounts the grain used for bread-stuffs represent 93 and 143 kg respectively — the home-consumption has shown a still greater increase, so that the demand for grain, at the present day, must to a considerable extent be supplied by means of importation. This development has passed through the following phases. In early times Sweden, as a rule, existed on its own harvests. During the 18th century, some hundreds of thousands of quintals of barley and rye were usually imported every year, but, during the latter part of the century and at the beginning of the 19th century, a still larger amount of grain was probably employed for the manufacture of spirits. From the decade 1820—30 the crops of bread-grains (rye, wheat, and barley) produced in the country were sufficient most years to supply the home demand for grain, and there soon came

SWEDEN
1 : 8 500 000
100 km.
200
Cercle polaire
Arctic circle
Norra polcirkeln
Polarkreis
NORRBOTTENS LÄN
VÄSTERBOTTENS LÄN
VÄSTER-NORRLANDS LÄN
JÄMTLANDS LÄN
GÄVLEBORGS LÄN
KOPPARBERGS LÄN
VÄRMLANDS LÄN
VÄSTMANLANDS LÄN
ÖREBRO LÄN
SÖDERMANLANDS LÄN
UPPSALA LÄN
STOCKHOLMS LÄN
STOCKHOLM
GÖTEBORGS OCH BOHUS LÄN
ÄLVSBORGS LÄN
SKARABORGS LÄN
ÖSTERGÖTLANDS LÄN
JÖNKÖPINGS LÄN
KALMAR LÄN
GOTTLANDS LÄN
Visby
Öland
KRONOBERGS LÄN
HALLANDS LÄN
KRISTIANSTADS LÄN
MALMÖHUS LÄN
Malmö
Kristianstad
Karlskrona
Ystad
Trelleborg
Hälsingborg
Helsingör
Varberg
Halmstad
Göteborg
Strömstad
Karlstad
Örebro
Falun
Gävle
Söderhamn
Sundsvall
Östersund
Härnösand
Umeå
Skellefteå
Piteå
Luleå
Haparanda
Gällivare
Kiruna
Kiruna vara
Luossavara
Mjölkudden
Vadstena
Motala
Norrköping
Linköping
Jönköping
Växjö
Kalmar
Oskarshamn
Västervik
Nyköping
Eskilstuna
Uppsala
Västerås
Örebro
Karlstad
Skara
Vänern
Vättern
Hjälmaren
Mälaren
ATLANT. OCEAN
NORGE
SVERIGE
FINLAND
DANMARK
Bottniska viken
Gulf of Bothnia
Golfe de Bothnie
Bottenhavet
Gulf of Bothnia
Bottenhafen
Bottenwiek
Gulf of Bothnia
Östersjön
Mer Baltique
Baltic Sea
Ostsee
Wheat culture in 1910.
In % of the total cereal seed
—1 %
1—5 »
5—ω »
565
12 Est de Greenw
16
East of Greenw
20
22
Ostl v Greenw
123 483
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TABLE 14. *Survey of Cereal Cultivation in Sweden.*[1]

Annually	Area under cultivation hectares	Crops, etc., of all kinds of grain quintals					Crop per hectare quint.[3]
		crop	demand	surplus or deficit[2]	for seed	for consumption	
1801—20 . .	552 150	6 620 000	6 960 000	340 000	1 187 000	5 773 000	12·0
1821—40 . .	724 300	9 025 000	9 040 000	15 000	1 560 000	7 480 000	12·5
1841—60 . .	911 000	12 043 000	11 589 000	**454 000**	1 963 000	9 626 000	13·2
1861—80 . .	1 289 926	17 225 000	16 207 000	**1 018 000**	2 770 000	13 437 000	13·4
1881—90 . .	1 565 992	21 392 000	21 823 000	431 000	3 229 000	18 594 000	13·7
1891—00 . .	1 687 765	23 429 000	25 399 000	1 970 000	3 416 000	21 983 000	13·9
1901—10 . .	1 700 085	23 389 000	27 161 000	3 769 000	3 339 000	23 822 000	13·8

[1] It need scarcely be said that the figures for earlier periods are very uncertain. The crops for the years 1821—40 are here increased by approximately about 6 %, the original figures being evidently too low. — [2] The leaded figures show the excess (of exports), the others the deficit (i. e., the excess of imports), in making which calculations there have been added together the amounts of unground grain (including maize) and of flour and shelled grain, but not of bran, starch, yeast, and bread, the annual imports of which during 1901—10 amounted to about 1 million quintals, chiefly bran. The import of maize for the years 1891—1900 amounted to about 150 000 quint. and for the years 1901—10, to about 90 000 quint. — [3] The figures for early years are exceedingly unreliable. The comparatively small increase is due to the extended cultivation of oats, this grain yielding less per hectare than the other cereals.

into existence an increasing export, first of oats and, beginning with the forties, of barley, rye, and wheat, too. About 1860 this condition of things altogether changed, so that every year there was an increasing surplus of imports over exports of rye and wheat, but this was long counterbalanced by the export of oats, which, during the seventies, was one of the most important exports of Sweden. The export of oats, however, also began to decline during the latter part of the eighties, in consequence of the increasing demand for fodder, which was a consequence of the vigorous development of cattle-farming, and since the year 1902, the import of this kind of grain, too, has exceeded the export. During the last few years, the value of the imports of cereals has exceeded that of the exports by from 40 to 60 million kronor per annum (cf. Table 8).

The winter grain cultivated in Sweden consists of wheat and rye, but these cereals, however, although on a small scale, are also cultivated as spring seed,

TABLE 15. *Cereal Cultivation and Consumption per Inhabitant.*[1]

Annually	All cereals, kg per head				Wheat and rye, kg per head				Other cereals, kg per head			
	Crop	Demand	Seed	Cons.	Crop	Demand	Seed	Cons.	Crop	Demand	Seed	Cons.
1801—20	**272**	286	49	237	**93**	104	16	88	**179**	182	33	149
1821—40	**313**	314	55	259	**114**	115	18	97	**199**	199	37	162
1841—60	**347**	334	57	277	**131**	130	19	111	**216**	204	38	166
1861—80	**407**	383	66	317	**131**	155	19	136	**276**	228	47	181
1881—90	**458**	468	69	399	**135**	186	19	167	**323**	282	50	232
1891—00	**475**	515	69	446	**143**	195	19	176	**332**	320	50	270
1901—10	**441**	512	63	449	**144**	199	18	181	**297**	313	45	268

[1] The difference between the crops and the demand consists of the excess of imports or of exports. Respecting the consumption of wheat and rye separately, see Table 35, p. I, 171. — The mean population during the above seven periods amounted to 2 436 000, 2 883 000, 3 474 000, 4 233 000, 4 673 000, 4 932 000, and 5 310 000.

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TABLE 16. *Cereal Cultivation by Läns.* Average 1901—1910.

Län	Area			Harvest						
	Winter-grain	spring cereals	legu-min.	wheat	rye	barley	oats	meslin	legu-min.	total
	har	har	har	quintals	quintals	quintals	quintals	quintals	quintals	quintals
Absolute numbers.										
Stockh.[1]	25 204	44 107	5 124	101 706	269 786	70 059	358 964	151 474	79 572	**1 031 561**
Uppsala	20 908	45 070	3 813	104 118	223 521	173 755	228 981	207 639	44 768	**982 782**
Söderm.	25 220	49 813	3 258	112 795	249 719	42 552	486 802	121 109	43 644	**1 056 621**
Österg.	38 266	82 508	5 258	136 875	486 473	180 112	494 903	557 422	66 811	**1 922 596**
Jönköp.	18 213	52 026	486	9 491	304 841	38 698	737 845	16 085	5 791	**1 112 751**
Kronob.	13 110	43 025	615	2 914	206 942	92 088	497 610	1 432	655	**801 641**
Kalmar	36 406	54 019	1 546	61 648	427 315	165 505	479 043	13 053	18 789	**1 165 353**
Gottl.	14 892	20 388	379	48 268	163 352	202 022	33 491	27 750	4 883	**479 766**
Blekinge	15 979	21 060	1 317	29 653	202 207	28 584	174 818	26 499	3 933	**465 694**
Krist.	39 676	76 147	2 450	120 042	482 388	170 715	458 031	373 929	24 238	**1 629 343**
Malmöhus	50 535	124 610	2 315	591 144	509 536	847 361	812 482	785 426	36 133	**3 582 082**
Halland	20 512	48 042	987	67 265	323 330	44 820	674 790	83 252	19 418	**1 212 875**
Göt. o. Boh.	10 284	39 746	2 752	13 259	136 101	43 843	362 430	11 488	42 138	**609 259**
Älvsb.	24 465	83 534	1 012	21 579	309 492	7 915	1 010 977	6 474	10 706	**1 367 143**
Skarab.	44 204	111 250	4 484	81 781	517 576	32 353	1 239 053	41 671	50 609	**1 963 043**
Värml.	25 190	68 466	460	8 282	385 693	7 897	701 814	2 331	4 294	**1 110 311**
Örebro	19 967	45 937	1 589	48 718	229 236	18 851	548 691	14 080	14 021	**873 597**
Västm.	19 727	44 700	2 162	73 707	216 401	37 550	491 205	67 299	27 965	**914 127**
Kopparb.	10 073	29 301	469	6 464	164 582	32 689	374 652	6 816	2 488	**587 691**
Gävleb.	2 910	27 491	464	1 443	55 230	175 898	248 907	13 778	4 734	**499 990**
Västern.	1 808	22 231	240	—	17 115	182 059	51 995	4 179	625	**255 973**
Jämtl.	785	10 377	710	—	7 154	87 138	4 892	1 903	3 587	**104 674**
Västerb.	546	20 887	11	—	3 810	145 329	2 780	5 354	—	**157 273**
Norrb.	470	14 000	—	—	5 884	141 999	10 668	—	—	**158 551**
Whole Kingdom	**479 350**	**1 178 735**	**41 901**	**1 641 152**	**5 897 684**	**2 969 792**	**10 485 824**	**2 540 443**	**509 802**	**24 044 697**
In % of figures for whole country.	%	%	%	%	%	%	%	%	%	
Stockh.[1]	5·26	5·74	12·23	6·20	4·57	2·36	3·42	5·96	15·61	**4·29**
Uppsala	4·36	3·82	9·10	6·35	3·79	5·85	2·18	8·17	8·78	**4·09**
Söderm.	5·26	4·23	7·78	6·87	4·23	1·43	4·64	4·77	8·56	**4·39**
Österg.	7·98	7·00	12·55	8·34	8·25	6·06	4·72	21·94	13·11	**8·00**
Jönköp.	3·80	4·41	1·16	0·58	5·17	1·30	7·04	0·63	1·14	**4·63**
Kronob.	2·73	3·65	1·47	0·18	3·51	3·10	4·75	0·06	0·13	**3·33**
Kalmar	7·59	4·58	3·69	3·76	7·25	5·57	4·57	0·51	3·69	**4·85**
Gottl.	3·11	1·72	0·90	2·94	2·77	6·80	0·32	1·09	0·96	**2·00**
Blekinge	3·33	1·79	3·14	1·81	3·43	0·96	1·67	1·04	0·77	**1·94**
Krist.	8·28	6·46	5·85	7·31	8·18	5·75	4·37	14·72	4·75	**6·78**
Malmöhus	10·54	10·57	5·52	36·02	8·64	28·53	7·75	30·92	7·09	**14·90**
Halland	4·28	4·08	2·36	4·10	5·48	1·51	6·44	3·28	3·81	**5·04**
Göt. o. Boh.	2·15	3·37	6·57	0·81	2·31	1·48	3·46	0·45	8·26	**2·53**
Älvsb.	5·10	7·09	2·41	1·31	5·25	0·27	9·64	0·26	2·10	**5·69**
Skarab.	9·22	9·44	10·70	4·98	8·77	1·09	11·82	1·64	9·93	**8·16**
Värml.	5·26	5·81	1·10	0·50	6·54	0·27	6·69	0·09	0·84	**4·62**
Örebro	4·17	3·90	3·79	2·97	3·89	0·64	5·23	0·56	2·75	**3·63**
Västm.	4·12	3·79	5·16	4·49	3·67	1·27	4·68	2·65	5·48	**3·80**
Kopparb.	2·10	2·49	1·12	0·39	2·79	1·10	3·57	0·27	0·49	**2·44**
Gävleb.	0·61	2·33	1·11	0·09	0·94	5·92	2·37	0·54	0·93	**2·08**
Västern.	0·38	1·89	0·57	—	0·29	6·13	0·49	0·16	0·12	**1·06**
Jämtl.	0·16	0·88	1·69	—	0·12	2·94	0·05	0·08	0·70	**0·44**
Västerb.	0·11	1·77	0·03	—	0·06	4·89	0·03	0·21	—	**0·65**
Norrb.	0·10	1·19	—	—	0·10	4·78	0·10	—	—	**0·66**
Whole Kingdom	**100·00**	**100·00**	**100·00**	**100·00**	**100·00**	**100·00**	**100·00**	**100·00**	**100·00**	**100·00**

[1] Stockholm city and län.

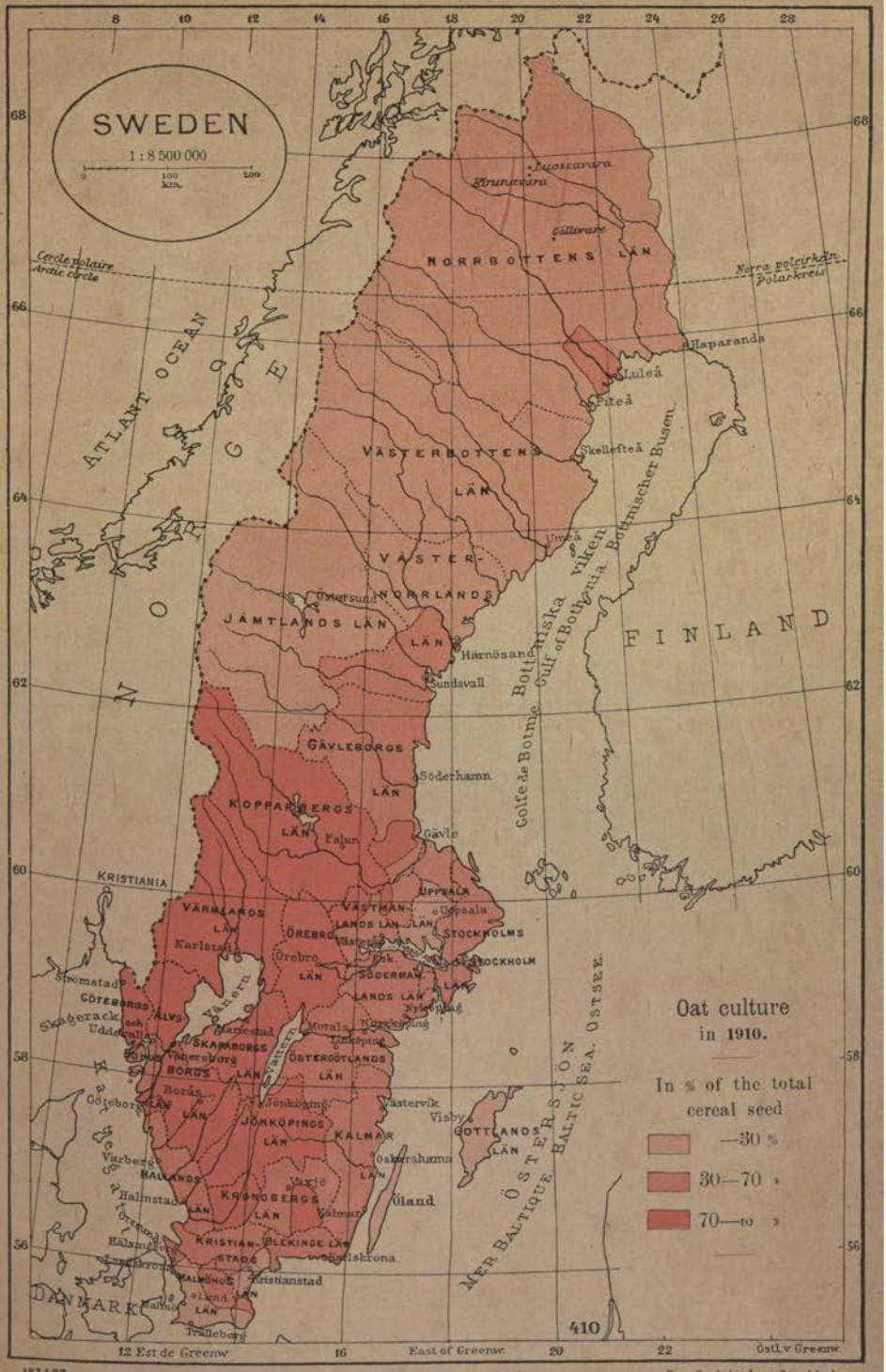

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TABLE 17. *Imports and Exports of Wheat.* Quintals.

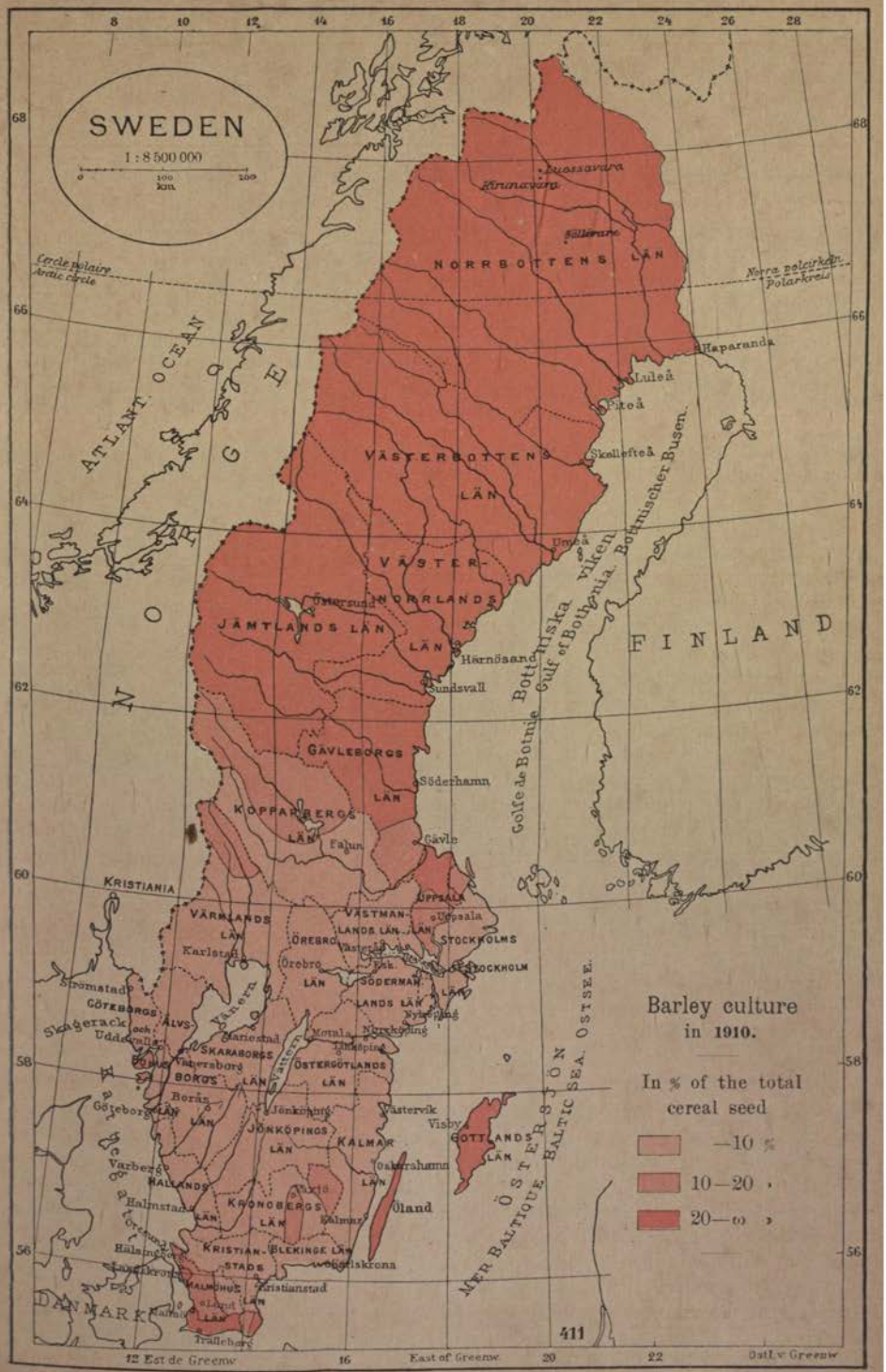
Annually	Imports			Exports			Excess of imp. (—), exp. (+)
	grain	flour	total [1]	grain	flour	total [1]	
1816—20	14 989	51	**15 057**	537	570	**1 297**	— 13 760
1821—40	1 456	104	**1 595**	5 423	1 889	**7 942**	+ 6 347
1841—60	17 370	5 384	**24 549**	35 558	817	**36 647**	+ 12 098
1861—80	32 985	178 416	**270 873**	78 684	17 019	**101 376**	— 169 497
1881—90	459 427	283 904	**837 966**	9 593	44 194	**68 518**	— 769 448
1891—00	1 253 356	159 168	**1 465 580**	271	8 435	**11 518**	— 1 454 062
1901—10	1 969 990	75 776	**2 071 025**	701	831	**1 809**	— 2 069 216
1911	1 723 597	70 356	**1 817 405**	1 611	5 016	**8 299**	— 1 809 106
1912	1 710 540	66 045	**1 798 600**	2 094	4 394	**7 953**	— 1 790 647
1913	1 998 153	86 834	**2 113 932**	—	2 066	**2 754**	— 2 111 178

[1] The flour is here increased by $^1/_3$ of its weight, in order to reduce it to unground grain

spring wheat chiefly in Halland and in the southern parts of the Läns of Älvsborg and Kalmar, spring rye mostly in Småland and Blekinge and in the Läns of Kristianstad and Älvsborg. Of the entire cultivated area in 1911, 487 730 hectares, or 13·3 %, were devoted to winter seed; 1 188 487 hectares, or 33 %, to spring seed.

Of *wheat*, which is cultivated practically only on the clayey plains and chiefly in Skåne, Gottland, Öster- and Västergötland, and in the provinces round Lake Mälaren, there were formerly cultivated chiefly old native sorts suited to the climate, but which gave somewhat poor returns. During the last two decades, several selected kinds of this grain, derived chiefly from the Swedish Seed Association's cultivation establishment at Svalöv and some of these improved kinds of grain, such as the grenadier- and extra squarehead wheat have, in Skåne, for the most part supplanted the ordinary native wheat. Farther to the north, where the climate is a more severe one, there have also been tried new sorts of wheat, selected at Svalöv, such as "selected squarehead" (Sw. renodlad squarehead), Bore- and Poodle-wheat, which surpass the ordinary sorts as far as regards productiveness, but these improved sorts being less hardy than the old native sorts, they have not ousted the latter, which still predominate; among these are, for example, in the Lake Mälaren districts, a white-eared velvet wheat, mixed with a red-eared smooth wheat, while here and there, on stiff soils, in Skaraborg Län especially, the very stiff-strawed club-wheat is much cultivated.

Rye is cultivated very generally in Southern and Central Sweden, on all soils, but especially on loam-, sand- and gravelly land. On the whole, rye occupies a greater area in the eastern läns than in the western, this being partly the result of rye being less susceptible than spring-seed to the drought which prevails in these parts of the country during the early summer. In Upper Norrland, winter rye is little cultivated, but gains in extent in the same proportion that rotation of crops with fallow is introduced there. In the southern part of the country, winter rye has in general been cultivated, with short clubby grains, derived in part from the probsteij rye that has been introduced; the rye cultivated in the northern part of the country has generally smaller and longer grains. In the southern and central parts of the country, the native sorts have, in no inconsiderable degree, been supplanted by the German Petkus-rye, which has been introduced of late years and gives better returns, but which, on the other hand, is not hardy enough for Northern Sweden. In the latter part of the country there is employed, although on a smaller scale



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than before, sowing-seed from Finland, the rye from which country — which is similar in climate to the north of Sweden — is celebrated for its great hardiness, the result, in part, of its being kiln-dried as a rule. In consequence of the smallness of the grains of the sort used and its inclination to stool richly, it is customary in the north of Sweden to sow only small quantities of seed, which, in the case of kiln-dried Finnish rye, may be less than 1·2 hectoliters (80 kg) per hectare, while the amount of sowing-seed sowed in Southern Sweden is usually about 3 hectoliters (200 kg) per hectare. In consequence of rye absorbing a great part of its nutriment during the autumn and ripening early, it is, in these respects, less dependent on climate and on the length of the summer, and in Northern Sweden, therefore, it usually gives just as rich crops as in the south of the country, the Läns of Kopparberg and Gävleborg especially being distinguished for their rich rye-crops. Besides winter-rye, there are also cultivated, although on a smaller scale, midsummer- and spring-rye. Midsummer-rye, which, from its method of growing, is also called tufted rye (Sw. tuvråg), is sown at midsummer or later on in that season, so that it has time to take good root before the winter sets in; it is cultivated in Southern and Central Sweden and principally on light soils, where the young growth of the ordinary winter-rye would easily be withered by the frost. Midsummer-rye is sowed with spring-seed (principally oats), too, which in the autumn yields a green-fodder crop, after which a ripe rye crop is obtained in the following year. In the upper part of Norrland it is sown in the spring, together with barley, when sowing grass-land, this enabling a barley crop to be cut the first year, and then, the following year, such a light crop of rye that the growth of the grass is not hindered by such a harvest. Spring-rye, which, as far as the fertility of the land and its manuring are concerned, is one of the least exacting of cereals, but also one of the least productive, is nowadays cultivated only to a very small extent, chiefly on poor sandy soils, either alone or together with oats.

Barley, which was formerly the cereal produced most largely in Sweden, has gradually declined in importance, not only relatively to other kinds of grain, but during the last few decades, absolutely, as regards the area devoted to its cultivation and to the amount of the crop (Tables 10 and 11), so that, nowadays, in consequence of the reasons already given, it is only in Upper Norrland that any great area is devoted to its cultivation. It has, too, fallen more and more into disuse, with the result that to-day only an inconsiderable amount is em-

TABLE 18. *Imports and Exports of Rye.* Quintals.

Annually	Imports			Exports			Excess of imp. (−), exp. (+)
	grain	flour	total [1]	grain	flour	total [1]	
1816—20	160 131	642	**160 987**	1 113	24	**1 145**	— 159 842
1821—40	40 210	2 323	**43 307**	11 134	999	**12 466**	— 30 841
1841—60	84 335	36 827	**133 438**	130 571	390	**131 091**	— 2 347
1861—80	711 049	263 769	**1 062 741**	32 411	5 661	**39 959**	— 1 022 782
1881—90	1 439 989	221 279	**1 735 028**	8 644	16 738	**30 961**	— 1 704 067
1891—00	1 005 974	102 110	**1 142 121**	923	16 741	**23 244**	— 1 118 877
1901—10	871 676	54 529	**944 381**	390	36 040	**48 443**	— 895 938
1911	461 856	49 650	**528 056**	405	10 744	**14 730**	— 513 326
1912	1 068 292	74 502	**1 167 628**	438	2 934	**4 350**	— 1 163 278
1913	911 835	125 913	**1 079 719**	—	968	**1 290**	— 1 078 429

[1] The flour is here increased by $^1/_5$ of its weight, in order to reduce it to unground grain.

TABLE 19. *Imports and Exports of Barley.* Quintals.

Annually	Imports	Exports	Excess of imp. (—), exp. (+)	Annually	Imports	Exports	Excess of imp. (—), exp. (+)
1816—20 . .	60 826	2 079	— 58 747	1881—90 . .	80 330	235 467	+ 155 137
1821—30 . .	19 085	14 730	— 4 355	1891—00 . .	62 359	20 236	— 42 123
1831—40 . .	39 304	18 212	— 21 092	1901—10 . .	24 871	871	— 24 000
1841—50 . .	8 618	67 121	+ 58 503				
1851—60 . .	33 968	191 025	+ 157 057	1911 . . .	12 795	53 795	+ 41 000
1861—70 . .	50 048	243 702	+ 193 654	1912	61	32 774	+ 32 713
1871—80 . .	77 372	349 560	+ 272 188	1913	122	12 753	+ 12 631

ployed for bread, so that the barley-crops, though diminished, have long been more than sufficient for the home consumption. From the beginning of the last decade of the 19th century, however, the home production has not been equal to the demand in all years, so that the import of this kind of grain, too, often exceeds the export. In the last years, however, a considerable excess of exports is again to be noted.

The barley harvest is, nowadays, employed only to a small degree for human food, and then in the form of meal and shelled grain; its chief use is for fodder and, in the case of the better sorts, for double-rowed barley, for the manufacture of brewing-malt.

In the north of Sweden, and also in the southern highland districts, the early ripening bere or six-rowed (very often but incorrectly called four-rowed) barley is grown exclusively and even on the clayey soils of the plains this variety is in fairly general use for grain- and straw-fodder. The two-rowed barley, which is more exacting as regards the fertility of the ground, and is especially fond of a soil rich in lime, is cultivated over larger areas, chiefly in the marl-districts of the country, South-Western Skåne, Gottland, Öland, Östergötland, Närke, and Uppland, and in the first three of the tracts mentioned, yields very fine malting barley. Of the six-rowed barley chiefly old native varieties are grown, while, on the other hand, the varieties of two-rowed barley (Sw. gumrik, flättring, grovkorn), which have been grown from very early days, have, in a great measure, been ousted by higher-class, selected sorts, chiefly obtained from the Sowing Seed establishment at Svalöv. Among these are new strains of the English Chevallier barley, the Princess- (selected out of Prentice), the Hannchen- and Primus barley.

Oats, which, in earlier times, were grown on only a very small part of the area devoted to agriculture, and then chiefly on meadow-land temporarily under cultivation, have since come to occupy an increasingly prominent place among the cereals of Sweden. While, at the beginning of the 19th century, oats were grown on only little more than one-fifth of the cereal-bearing soil, and gave a

TABLE 20. *Imports and Exports of Oats.* Quintals.

Annually	Imports	Exports	Excess of imp. (—), exp. (+)	Annually	Imports	Exports	Excess of imp. (—), exp. (+)
1816—20 . .	5 214	4 308	— 906	1881—90 . .	29 307	1 977 100	+ 1 947 793
1821—30 . .	3 954	15 806	+ 11 852	1891—00 . .	117 735	878 991	+ 761 256
1831—40 . .	7 992	39 994	+ 32 002	1901—10 . .	690 528	90 218	— 600 310
1841—50 . .	109	146 697	+ 146 588				
1851—60 . .	2 099	426 261	+ 424 162	1911	1 020 519	280 918	— 739 601
1861—70 . .	2 851	1 381 059	+ 1 378 208	1912	972 888	52 368	— 920 520
1871—80 . .	7 970	2 405 272	+ 2 397 302	1913	643 362	683 723	+ 40 361

crop which, in proportion to the total harvest of the country, was of still smaller proportions, they are now cultivated on a larger area than that occupied by the rest of the Swedish cereals together, and give a good half of the total grain-crops of the kingdom, especially if we reckon its share in the meslin-harvest.

The oat-harvests exceeded the needs of the population at an earlier period than any other kind of grain, and ever since the beginning of the decade 1820—30, there has been a surplus for export, which gradually — and especially from the sixties — became very great indeed, but the growth of the cattle-farming industry led to ever-increasing demands on the oat-harvests, and since the middle of the eighties the export of oats has been steadily diminishing, while the imports have risen to such an extent that, from the year 1902, they have exceeded the exports.

As regards the extent to which oats are cultivated in different parts of the country, this grain forms, to a certain degree, a contrast to barley, as oats form the chief crops principally in the south-western part of the country, from Värmland to Halland, while they are less predominant in the eastern and northern läns. This is the result, in part, of the liking barley has for soils rich in lime, soils which, on the other hand, are less suitable for oats; we have seen that this preference of barley for such land is mostly observable in the marly districts of Gottland, Öland, South-Western and North-Eastern Skåne, and Östergötland. The predominance possessed by oats in other provinces depends especially on the lesser demands it makes on the character of the soil — the region mentioned above, lying in South-Western Sweden, has, on the whole, a poorer soil than that of the marl-lands of the eastern läns (cf. pp. 35 foll.) The smaller demands made by oats on the percentage of nutritive constituents of the soil have led to this cereal being less often cultivated on newly manured ground: it is generally the last course in the rotation of crops, after the soil, having produced a succession of other harvests, has lost most of the fertility given to it by the manure, together with other favourable conditions obtained from fallowing, or by the cultivation of root-crops, in combination with a thorough labouring of the ground. Oats, too, grow better than other grains on humous or peat soils that are poor in mineral constituents, and they form the chief crop on cultivated peat- and moorlands; in consequence of this fact, the cultivation of oats has greatly increased during the last forty years, simultaneously with the increase of the moor-area laid under the plough.

As a result of what has just been said, we find that oats are sown the thickest of all cereals and give, proportionately, the smallest yield of grain. The great amount of oats used for sowing, is, however, if compared with that of barley, so far illusory that one hectoliter of oats weighs less than 50 kg, while the same amount of two-rowed barley weighs about 70 kg, and six-rowed barley from 60 to 65 kg; 4 hectoliters of sowing oats per hectare, therefore, are not more than equal to 3·2 hectoliters of ordinary barley. The fact that the amount of grain used for seed in the north of Sweden is, throughout, greater than that used in the southern parts of the country is very probably due to the fact that the seed is not so well covered with soil, as, in that part of the country, the seed is sown by hand and not drilled; but the chief reason must certainly be that, in the northern parts of Sweden, the sowing seed has not attained to full maturity, and so does not possess perfect power of germination. The inferiority of oats in respect to the weight and value of the grain is made up for, to some extent, by the greater value of the straw, which, as fodder, is superior to other kinds of straw, and, after hay, forms the most important roughing for all kinds of cattle.

Many different varieties of oats are cultivated, with white, yellow, grey, light- or dark-brown coloured grain. At an earlier date, dark-brown varieties

predominated in the eastern läns of Sweden, while white sorts were most common in the western parts of the country, with, exceptionally, grey-grained varieties in tracts where agriculture had been much neglected (the more distant parts of Småland and Halland). Since the appearance of improved varieties, chiefly white-grained, those sorts have been more generally cultivated in the former black-oat districts. Of the two chief varieties, as distinguished by the form of the panicle, or the all-side and one-sided, or tartarian oats, it is chiefly the former that is cultivated, as it gives a better grain crop, while the latter, in consequence of its profuse development of straw and leaves, is grown mostly for green fodder. The old country varieties have, of late years, been replaced by improved sorts, obtained chiefly from the establishment at Svalöv, such as the white or yellow-white probstejer-, ligovo-, Victory (Sw. seger-), and gold-rain oats, and the dark-brown Great Mogul varieties.

In comparison with the straw-grain crops spoken of above, *the leguminous cereals* — peas, beans and vetches — occupy a more secondary position in Swedish agriculture, as they also do in that of other countries, and their cultivation is still decreasing (Table 10) in spite of the old experience that the cultivation of leguminous plants increases rather than diminishes the fertility of the soil, which experience has in our own days been confirmed and explained, and ought to have led to an increase in the cultivation of these plants. The reason of this is probably that these plants give a comparatively smaller yield than cereals. As regards their habitat, it may be said that they are distinctively lime-loving plants and are therefore chiefly cultivated within the marl districts, such as Östergötland, Bohuslän, Uppland, the country round Lake Siljan and Lake Storsjön in Jämtland, but on a comparatively smaller scale, in Skåne, Gottland, and Öland, in spite of the soil of these provinces being rich in lime. The probable cause of this circumstance, as far as regards Gottland and Öland, is that the soil there is too light for these plants. Pulse is little cultivated on land poor in lime, such as in Värmland and in the highlands of Småland and Västergötland.

Peas and vetches are cultivated both alone and also (and especially) together with oats and barley, as meslin, over the greater part of the country; beans thrive best in coast-districts and are chiefly cultivated in Bohuslän and the north of Halland.

Buck wheat, which was formerly cultivated pretty generally on sand- and moor-soils in the southern parts of the country, has gradually lost its importance and nowadays is chiefly grown on the poorest sand-soils in Skåne.

The prices of cereals in Sweden during the last six or seven decades are shown from the *general market prices* given in Table 21. In general they are

TABLE 21. *Market Prices of Cereals.* Kronor per quintal.[1]

Annually	Wheat	Rye	Barley	Oats	Annually	Wheat	Rye	Barley	Oats
1836—40 . . .	13·71	11·07	9·86	7·64	1881—85 . . .	15·33	12·37	11·60	9·76
1841—45 . . .	14·27	12·00	8·99	6·36	1886—90 . . .	12·82	10·05	10·06	8·15
1846—50 . . .	13·92	11·25	10·04	7·39	1891—00 . . .	13·15	11·50	11·18	9·15
1851—55 . . .	17·75	14·10	12·25	9·55	1901—10 . . .	13·67	12·59	12·30	10·57
1856—60 . . .	18·26	13·01	12·90	10·42					
1861—65 . . .	15·76	12·80	11·29	8·95	1911	15·25	13·35	13·24	11·10
1866—70 . . .	18·09	14·65	13·24	10·59	1912	15·42	14·20	13·81	11·56
1871—75 . . .	18·73	14·29	13·77	11·54	1913	14·52	13·71	13·11	10·95
1876—80 . . .	17·11	13·43	13·12	10·99					

[1] The prices given per hectoliter are reduced to weight, calculating that a hectoliter weighs: of wheat, 77·6 kg; of rye, 71·7 kg; of barley, 65 kg and of oats, 47 kg.

probably somewhat too low, but in any case they show approximately the course the changes in price have taken. Since 1888 these prices have become, to a certain degree, dependent on the import duties, as they were during the period *before* 1858. During the years 1858—87, cereals, on the other hand, could be imported free of duty into Sweden.

Finally, the **straw-harvest** is also a somewhat important feature of the cultivation of cereals. On an average the straw-crop obtained from winter grain (wheat and rye) is estimated at about 30 quintals per hectare or a little more, and that obtained from the spring cereals at about 20 quintals per hectare or a little more. The total amount, then, at the present time, is about 15 million quintals of winter grain straw and about 24 million quintals of spring grain straw, or altogether 39 million quintals. Other calculations give somewhat higher figures.

Root-crops.

Of root-crops proper (illustrations, see p. 53) there are cultivated in Sweden, besides potatoes, the white beet-root, turnips, and carrots. The development of this cultivation is shown, as far as the area of the land employed for the purpose is concerned, by the figures in Table 22, which, however, for other root-crops than potatoes, do not date farther back than to 1865, the year when the annual agricultural statistics first began to be issued.

The cultivation of the *potato* was introduced into Sweden in 1723 by Jonas Alströmer, but, as in most other countries, the new departure at first met with great distrust on the part of the people. Even at the beginning of the 19th century, the cultivation of the potato had not attained greater proportions than, as it is estimated, about 5 000 hectares. Growing experience of the value of the

TABLE 22. *Returns for Potatoes and other Root-crops.*

Annually	Potatoes				Other root-crops		
	area	crop; quintals [1]			area	crop, quintals [2]	
	hectares	total	per hectare	per inhab	hectares	total	per hectare
1801—10	7 100	693 000	97·6	0·25	—	—	—
1811—20	15 400	1 554 000	100·9	0·55	—	—	—
1821—30	39 400	4 242 000	107·6	1·37	—	—	—
1831—40	56 500	5 418 000	95·8	1·57	—	—	—
1841—50	76 500	7 070 000	92·4	1·86	—	—	—
1851—60	97 100	8 869 000	91·3	2·12	—	—	—
1861—70	129 000	9 800 000	75·9	2·02	9 301	—	—
1871—80	150 252	12 569 000	83·6	2·41	11 485	963 000	84
1881—90	155 096	12 850 000	82·8	2·75	17 650	2 504 700	142
1891—00	157 547	12 221 106	77·5	2·48	34 510	8 136 000	235
1901—10	153 246	14 797 000	96·5	2·79	70 670	18 205 800	257
1911	152 783	14 403 830	94·5	2·57	103 965	29 318 605	282
1912	·	16 222 920	·	2·89	·	31 604 878	·
1913	152 429	20 511 810	134	3·63	105 171	39 723 620	377

[1] Calculated weight, 70 kg per hectoliter, which, however, is probably a somewhat high figure for Sweden; since 1913 the figure 67 kg per hectoliter has been used. — [2] Calculated weight, 55 kg per hl for fodder root-crops.

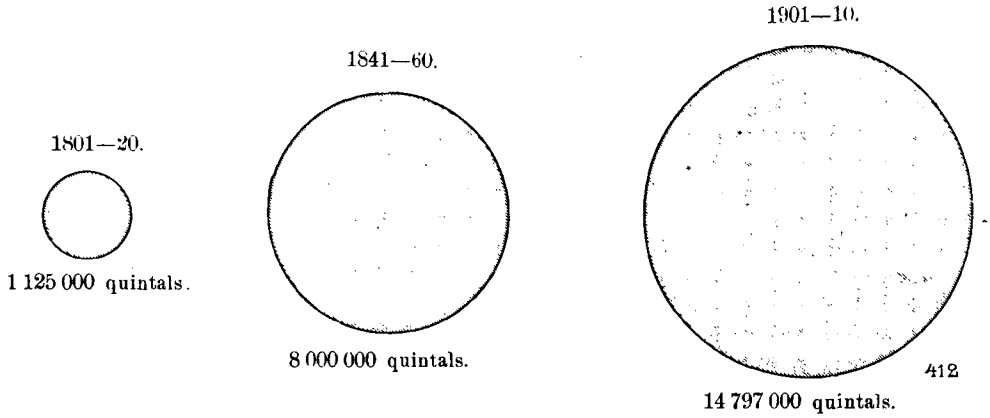
TABLE 23. *Cultivation of Potatoes and Root-crops.* Average for 1901—10.

Län	Area				Crops					
	Hectares		In % of whole Kingdom's		Quintals			In % of whole Kingdom's		
	potatoes	root-crops	potatoes	root-crops	potatoes	root-crops	sugar-beet	potatoes	root-crops	sugar-beet
Stockh.	5 872	578	3·83	0·82	648 887	169 626	—	4·39	1·71	—
Uppsala	3 955	555	2·58	0·79	359 311	165 143	—	2·43	1·66	—
Söderm.	4 261	1 161	2·78	1·64	340 372	350 289	—	2·30	3·53	—
Österg.	6 361	2 607	4·15	3·69	589 667	529 252	113 497	3·99	5·32	1·37
Jönköp.	7 224	2 050	4·71	2·90	685 657	548 306	—	4·63	5·52	—
Kronob.	7 986	1 084	5·21	1·53	861 337	217 005	—	5·82	2·18	—
Kalmar	7 420	2 416	4·84	3·42	632 378	398 225	81 539	4·27	4·01	0·99
Gottl.	2 834	3 135	1·85	4·44	253 050	153 973	479 063	1·71	1·55	5·79
Blekinge	8 668	1 373	5·66	1·94	870 016	300 631	80 787	5·88	3·02	0·98
Krist.	22 677	11 980	14·80	16 95	2 313 103	1 820 685	1 096 821	15·63	18·32	13·27
Malmöhus	12 231	30 274	7·98	42·84	1 367 530	2 174 190	6 279 738	9·24	21·88	75·95
Halland	5 549	3 201	3·62	4·53	567 226	920 308	91 155	3·83	9·26	1·10
Göt.o.Boh.	4 074	411	2·66	0·58	428 353	85 156	—	2·90	0·86	—
Älvsb.	9 064	1 129	5·92	1·60	812 007	255 255	—	5·49	2·57	—
Skarab.	9 654	4 596	6·30	6·50	684 343	876 725	45 726	4·62	8·82	0·55
Värml.	8 477	548	5·53	0·78	896 580	74 725	—	6·06	0·75	—
Örebro	5 799	1 305	3·79	1·85	442 407	288 176	—	2·99	2·90	—
Västm.	3 220	562	2·10	0·80	284 909	144 328	—	1·93	1·45	—
Kopparb.	3 495	735	2·28	1·04	475 193	273 495	—	3·21	2·75	—
Gävleb.	3 661	159	2·39	0·22	410 597	65 283	—	2·78	0·66	—
Västern.	4 706	238	3·07	0·34	353 564	36 113	—	2·39	0·36	—
Jämtl.	1 646	225	1·07	0·32	141 095	43 970	—	0·95	0·44	—
Västerb.	2 941	252	1·92	0·36	227 720	19 943	—	1·54	0·20	—
Norrb.	1 471	89	0·96	0·12	151 531	28 205	—	1·02	0·28	—
Whole Kingdom	153 246	70 663	100·00	100·00	14 796 833	9 939 007	8 268 326	100·00	100·00	100·00

potato as an article of food, and perhaps an equally great experience of its usability as raw material in the manufacture of spirits, brought about, from this time, a rapid increase in its cultivation, so that, at the middle of the century mentioned, the area devoted to the cultivation of the potato had risen to about 80 000 hectares. At the close of the century, this area had been almost doubled. The increase in the harvest, which is shown by the diagram on p. 68, has been in about the same ratio as the increase in area.

The increase in the crop-produce per area-unit which is shown to have taken place during the beginning of the 19th century was succeeded by a decline, which can probably be explained by the fact that the cultivation of the potato was removed from the small plots of kitchen-gardens ground out to the fields, where less attention was paid to the land and the care of the plants. It is only during later times that the returns per hectare have shown a decided increase, which has been mostly the result of the introduction of new and more productive varieties, chiefly of foreign origin; probably, too, it has been in part the result of improved manuring, especially in the most southerly parts of the country, where artificial manures have come into fairly general use also for this vegetable. The potato-crop per area-unit in Sweden is, however, still fairly low as compared with the state of things in the rest of Western Europe (see Table 13). That this is not the result of the northerly position of Sweden, or other unfavourable natural circumstances is, however, quite probable, as the potato-harvests in neighbouring countries are greater than in Sweden — in Norway being

Potato-crop: yearly averages.



more than 50 % greater — and as in Sweden itself the harvest does not decrease with the higher latitude in which the potato is grown, nor with the decreasing fertility of the soil. For a long time certain districts in Northern Sweden, Jämtland and the Läns of Gävleborg and Kopparberg, had the best potato-harvests, and, if of late years the Skåne Läns have reached equally high or even higher figures (see Table 23), this depends chiefly, as before mentioned, on the introduction of new varieties and the improved manuring. The high harvest-figures in the parts of Northern Sweden just mentioned are probably partly due to the fact that the soil in these regions, with their small parcels of land, receives more careful attention, resembling actual kitchen-gardening, together with the extended use of stable-manure. Another reason is that the devastating diseases which often reduce the yield of the potato-crop in the southern part of the country seldom occur in the north of Sweden.

During the period 1901—10, there were harvested in Sweden a yearly average of 14 797 000 quintals of potatoes (if a hectoliter is taken as weighing 70 kg). Taken per head of the population, this corresponds to 279 kg, a figure which is little below the average for Western Europe, which was 310 kg. If from this we subtract the seed-tubers, which are given at about 18 hl, or 1 260 kg per hectare, the annual amount of the harvest that, in Sweden, remained available for consumption, was, during the period above mentioned, about 243 kg pr head of the population. About 1 million quintals are used annually by the distilleries.

The consumption of potatoes, chiefly as human food but also for the manufacture of spirits, and, in a lesser degree, as food for cattle, pigs especially, has, from about 35 liters, or a weight of about 25 kg per inhabitant, at the beginning of the 19th century, risen to about 10 times this amount at the close of this period. For a long time the consumption was in proportion to the harvest, so that there were no noteworthy imports or exports, but, since the latter part of the nineties, a change has taken place in this respect, and there has been an excess of imports, to an annual average of about 200 000 quintals.

Apart from this, however, potatoes, in consequence of their great bulk, are, far less than grain, the object of transport and trade between different countries and districts, and, as a rule, the demand for potatoes in Sweden is supplied by local cultivation. The cultivation of potatoes, therefore, is very evenly distributed throughout the country and, as a rule, embraces about 30 hectares of land per 1 000 inhabitants. Its share of the cultivated land, which,

on an average for the whole country, amounts to something more than 4 %, is subject to somewhat great variations, and is higher in the less cultivated parts of the country and in those districts where small farming predominates, but is less on the extensive farms on the plains, whose clayey soils, too, are less suitable for the cultivation of potatoes than the light earth of the forest districts. A large proportion of the cultivated ground too, is, devoted to the cultivation of the potato in those districts where the manufacture of spirits is carried on on a large scale, such as in the Läns of Kristianstad, Blekinge, Jönköping, Kronoberg, and Skaraborg.

The varieties of potatoes cultivated differ greatly both in appearance and in taste. In Northern Sweden there have, as a rule, been retained the old-fashioned, ordinary round sorts with yellow flesh and rich crops, whose slight power of resistance against disease is of little importance in the districts mentioned, where potato-disease very seldom occurs: the character of this potato, however, does not make it suitable for cultivation in more southerly tracts. In the southern and central parts of the country, on the other hand, the old sorts of potatoes have been supplanted by newer and more productive varieties, which, in most cases, possess greater powers of resistance to disease; these varieties have been introduced from North America, England, and, of late, especially from Germany. Among the varieties now more commonly cultivated may be especially noticed two sorts, which have been much grown in Sweden since the seventies: the American "Early Rose" potato, which, however, is not capable of offering much resistance to disease, and the white English Magnum Bonum. In addition, there are also fairly generally cultivated the early, white table-potato Early Puritan, the medium-late Up-to-Date, which resembles the Magnum Bonum, and a number of productive, but coarse, German varieties, very rich in starch, such as the white Prof. Maercker, Geheimrath Thiel, Richter's Imperator, and Silesia.

The cultivation of the sugar-beet, which, in Sweden, was begun as early as during the second decade of the 19th century, but which cannot be said to have gained a firm footing in the country before the fifties, has gradually made great progress and, during the last few decades, has developed enormously. After the unsuccessful attempts which were made about 1870 to extend the cultivation of the sugar-beet to Central Sweden, and all beet-sugar factories north of Skåne soon had to be closed again, the Swedish sugar-beet cultivation was long restricted to that province, where the natural conditions necessary are better satisfied than anywhere else in the country. Since the beginning of the nineties, the cultivation of the sugar-beet has once more been extended and at the present day is carried on in Halland, Blekinge, Southern Kalmar Län, Öland, Östergötland, and Västergötland. Since the middle of the nineties, the area devoted to the cultivation of the sugar-beet has risen from about 18 000 hectares to nearly 30 000 hectares in 1911, and during the same period, the crop has about doubled; during the years 1901—10, it amounted to 8 268 808 tons, or 27·8 tons per hectare, figures little inferior to those for the countries which stand highest in this respect — the Netherlands and Belgium. The percentage of sugar has been steadily on the increase, so that the amount of raw sugar obtained has risen from 6·6 % per weight-unit in 1870 to 15·77 % in 1912. The kind which is cultivated is of the German Klein-Wanzerbener variety, the seed being mostly obtained from Germany.

In addition to the considerable direct income that the cultivation of the sugar-beet gives the farmer, it also confers the advantages of a more thorough tilling, weeding and manuring of the soil than other plants demand and repay by their crops, so that the cultivation of the beet prepares the way for increased and more

even harvests of other plants, too. These advantages would be conferred by the cultivation of other root-crops, too, if the same attention were paid them, which is, as a rule, not the case, although their cultivation is calculated to increase the productiveness of the soil and of cattle-rearing, too, as they provide supplies of juicy fodder. The area devoted to the cultivation of root-crops, in proportion to the entire cultivated area, can therefore with good reason, be regarded as a measure of the standard to which agriculture and cattle-rearing have attained.

It is only of late that the cultivation of root-crops has become very general, but, in spite of the fact that the area employed for such cultivation has during the last quarter of the century very rapidly increased from 25 000 hectares in 1890 to 104 000 hectares in 1911, the root-crops in the year last-mentioned did not occupy fully 3 % of the cultivated land of the country. Those crops are mostly cultivated in Malmöhus Län, where the area devoted to them is more than 10 % of the whole area of cultivated land, this län supplying over one-third of the total root-crops of the country (the sugar-beet included) and nearly one quarter of the total harvest of fodder root-crops. The other läns, too, where the sugar-beet is cultivated, as well as the Läns of Kopparberg, Jönköping, and Jämtland, carry on the cultivation of fodder root-crops more extensively than do other parts of the country. On the whole, this important branch of agriculture is still much neglected over the greater part of the country, this being partly the result of a want of knowledge of its great economic importance, though it is also the result of the difficulty there exists in procuring the labour necessary for the proper culture of such crops.

Among fodder root-crops, the beet is much grown in the clayey soils of Southern Sweden, but of the other species, the turnip is the one most cultivated, being in fact the only one grown in Northern Sweden; the variety chiefly cultivated is the long, white-fleshed Bortfelder turnip. The Swedish turnip and the carrot are cultivated less; the former chiefly on stiff clay soils, the latter on sandy and humous-soils.

Fodder-crops.

Of the total area of cultivated land in 1911, or 3 654 925 hectares, 1 357 763 hectares were devoted to the growth of fodder, this being a proportion of 37·1 %. It has already been shown (p. 44) how this relative proportion has been increased of late years. Of the area just stated, 164 341 hectares are employed for pasture or green-fodder crops, and 1 193 422 hectares for hay crops.

The fodder-crops, which are most generally cultivated as leys in Sweden, are mixtures of timothy and red- and alsike or hybrid clover. Timothy was grown in Dalarne as early as in the 18th century. Linneus found alsike clover in 1750, growing wild on the ditch-sides in Alsike parish in Uppland. He drew the attention of the farmers to this fodder-plant, as a hardy one which was not exacting with regard to climate; now it is cultivated in most other countries.

It was not before the system of rotation of crops was introduced that seeds were grown on a large scale. As a rule the leys were retained for 3—4 years; in Norrland, as a rule, this time has been much longer, but as, in the absence of manuring, their yield diminished greatly after the second year, it has now become a fairly general custom to plough up such fields after the second or even after the first year. In the south of Sweden there are grown, together

with, or instead of, timothy and clover, various other grasses and leguminous plants, such as Italian and English rye-grass, common brome-grass, meadow-fescue, tall oat grass, trefoil, and kidney-vetch. In addition to the leys that are kept for only one or two years, it has lately become the custom to form perennial pasture lands, where the greater part of the plants consist of more hardy growths, such as meadow-fescue, cock's-foot, tall oat grass, meadow foxtail, bird's-foot trefoil, and, above all, lucerne, which is cultivated alone and will give rich harvests for many years in succession.

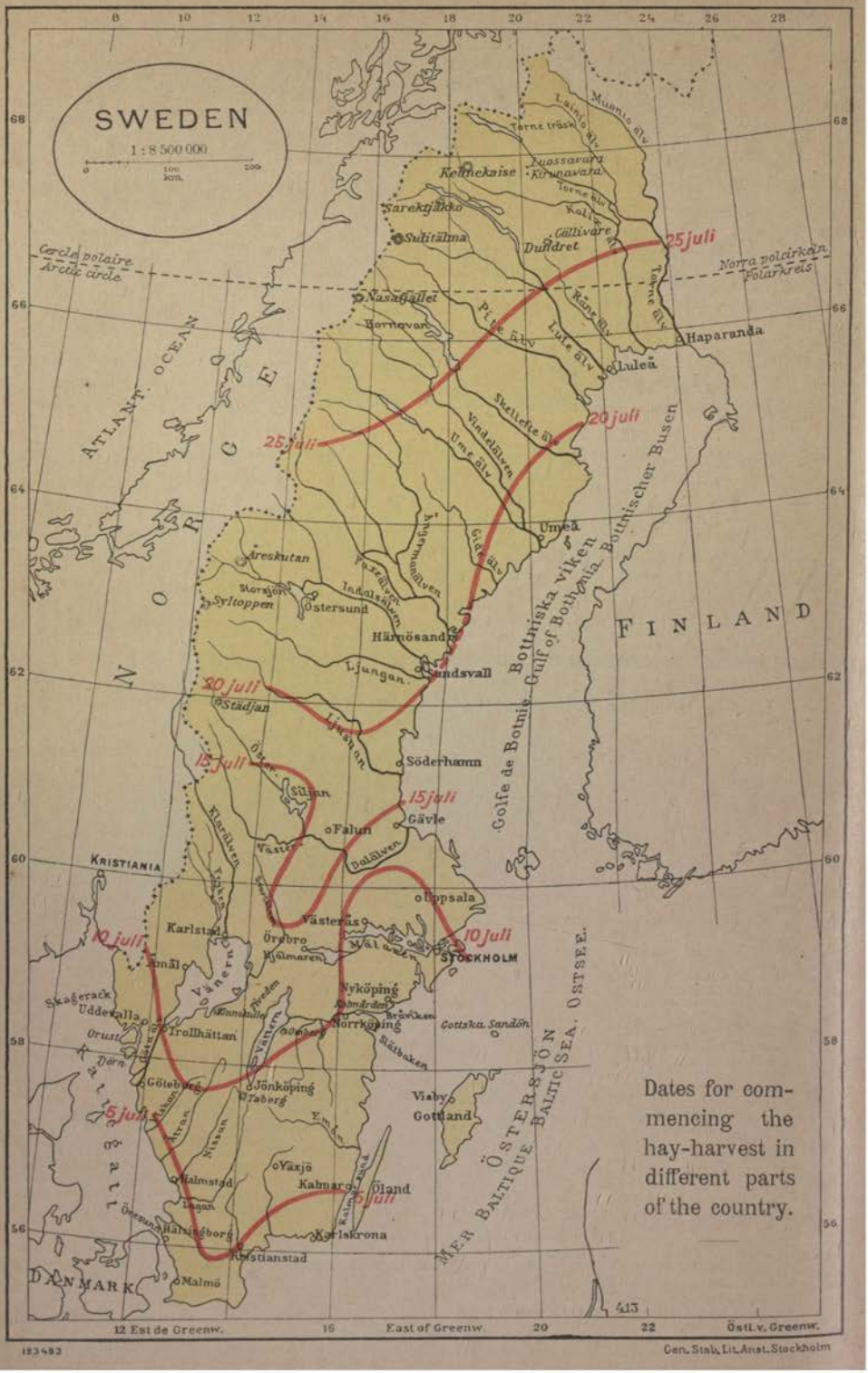
The harvest from artificial leys amounts, according to the Swedish official statistics, to 25—35 quintals per hectare, making a total at the present day of 30—40 million quintals in ordinary years. In addition to this, there is the hay-harvest from **natural meadows**, which is calculated at about 10—12 quintals per hectare, or a total of about 15 million quintals.

The total hay-harvest, apart from the pasturage, thus usually amounts to more than 50 million quintals, of a value of about 250 million kronor, or about 1/3 of the value of the total harvests of the country.

Of *seed* (clover, timothy, etc.), the harvest was given in 1911 as no less than 63 420 quintals, but usually falls as low as about 55 000 quintals; the figures adduced in this respect, however, are very incomplete. The *import* of grass-seed in 1910 amounted to 15 830 quintals and usually varies between 30 000 and 40 000 quintals (after subtracting the amount exported), from which it is seen that the home production is insufficient and usually supplies only about 60 % of the seed needed.

Sweden possesses very extensive areas of natural **pastures**, but there are no accurate figures to be had, either of its area or yield.

Formerly, and as long as the two-yearly and a three-yearly rotation of crops were generally employed, the larger live stock were allowed during the summer to find their food on the fallow-lands, and, after the hay-harvest on the natural meadows in enclosed pasture packs as well as in the forests. The pasture-lands are still of great importance in many parts of the country. In Norrland and in Dalarne, forest- and mountain-pasturage is still relied upon, the cattle being taken there from the farms in the early part of the summer; temporary, roughly constructed dwellings are found at such places, and are called *fäbodar* (cattle-cottages); here the women and girls who tend the grazing cattle live, and here they make the butter and cheese. In Central and Southern Sweden, pasturage is nowadays employed only on a small scale for milk-cows; on farms where the cultivation is developed to a higher standard the cattle graze only on the leys, while the pasturage in the enclosed groves are chiefly reserved for foals and young cattle. Small farmers, cottagers, and day-labourers on farms, in many places let their cattle graze in forest pastures, but the right to do so is nowadays being restricted in places where modern methods of forest-culture have been introduced. In many läns it is forbidden to allow goats to graze in the woods, a fact that has contributed to reducing the numbers of these animals. Where the woods are the object of greater care, sheep, too, are not willingly allowed to pasture there. The best enclosed pastures in the south of Sweden are probably to be found in Småland, and especially in the island of Gottland, where the ground is covered with various kinds of grass and a multitude of herbs, many of the latter being leguminous. Foliage-trees of various kinds, mostly oak and birch, stand there, either singly or in more or less dense groups in the small parks. — Of late years, as we have mentioned above, the farmers have commenced to form permanent grass-lands which are employed both for hay-making purposes and for pasture.



Dates for commencing the hay-harvest in different parts of the country.

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Other cultivated plants

are of small importance for Swedish agriculture. Some data are given respecting the cultivation of *flax* and *tobacco* in the corresponding sections of the chapter on Swedish Industries. Rape, which was formerly cultivated to a fairly great extent in Skåne, Southern Halland, and in the island of Gottland is seldom cultivated nowadays.

The entire area of cultivated land which is employed for the production of other plants than grain, root-crops, or fodder-plants, amounted in 1911 to no more than 1 634 hectares, 1 531 hectares of which were devoted to flax.

Agricultural Implements.

In Sweden, as in most other countries, agricultural implements long remained at a very primitive standpoint and consisted for the most part of some few home-made tools. The strenuous efforts to improve the state of agriculture which arose at the close of the wars at the beginning of the 19th century found expression, too, in the introduction, principally by the efforts made by the newly-established Academy of Agriculture, of new, improved models of agricultural implements, chiefly of English origin. During this time, for example, was introduced the Scotch plough, on Small's model, provided with a share and mould-board, which more and more supplanted the native ironshod wooden ploughs, of which various types were in use in various districts. There were also introduced the ridging-plough, the extirpator, sowing machines of various kinds, winnowing-machines etc.

The new implement-models, however, were at first only adopted on the manor-farms, the peasantry holding stubbornly to their older forms. The new models, however, soon came into great demand after the establishment, commencing with the forties, of a fairly large number of Swedish factories for the manufacture of agricultural implements; amongst these may be mentioned Kockum's at Malmö, Keiller's in Gothenburg, Överrum in Kalmar Län, Nävekvarn, Hällefors, Åker- and Nykvarn in Södermanland, Breven's Factory in Närke, Forsvik in Värmland, and Furudal and Dalfors in Dalarne. In addition to this, the newly-established agricultural institutes (schools and highschools) actively contributed to the spread of the new implement-models, the implements being manufactured at the said schools and the pupils being made accustomed to their use. During the course of time, several additional foreign, and not a few new Swedish, models were adopted; the latter were usually modified constructions of foreign types. Such were the swing-plough, founded on Small's and the native Värmland-plough, the Åker- and Furudal-ploughs, on American models, the Scotch rhomboidal- and the English zig-zag harrow, broadcast corn-distributors and drills, horse-hoes, horse-rakes on wheels, etc.

During the sixties and seventies there took place a considerable import of English and American implements, but, at the same time, there was brought about a concentration of the home manufacture, the greater number of the smaller factories ceasing to exist, while several of the older factories, such as Överrum's, Munktell's, and Keiller's, and some newly-established works, such as Thermænius, at Hallsberg, and the Västeras Mechanical Workshops, were enlarged, and commenced the manufacture of various newly-introduced types. Nu-

merous exhibitions, too, contributed largely to making the new implement-models known and spread in all parts of the country and among the great bulk of the farmers. During this period, too, hay-making and harvesting machines, tiger-horse-rakes and peg-drum-threshing-machines were introduced and were soon manufactured within Sweden, too.

This development has continued ever since. New implement-models have been introduced from abroad, such as the multiple ploughs, the ring- and Cambridge rollers corn-screens, etc. in the eighties; the American ploughs with skimcoulter, share and mould-board of hard-tempered steel; springtooth- and disc-harrows, binder harvesters in the nineties, and extirpators on wheels and petrol-motors, in the first decade of the present century. Several native constructions, too, have been brought into the market, such as C. M. Wiberg's (of Ransta) "slad"-harrow and artificial manure-spreader and the balance-horse rake. Above all, the Swedish constructors have gained a notably prominent place in the sphere of dairy-machine technics and milking-machines, for a more detailed account of which the reader is referred to the section on the dairy-industry.

By means of new constructions and, above all, by alterations in older forms, the implement-market has been enriched with a number of various types suited to various conditions and available capital. Simultaneously, the technical perfection of the manufacture has also made progress, this having been essentially aided by the various factories devoting themselves to certain specialities, and that with such success that, nowadays, they not only render foreign-made goods unnecessary but can also compete with them in the foreign markets. Among the most prominent Swedish productions of agricultural implements may be mentioned: ploughs from Överrum, Norrahammar, Kockum's in Malmö, and Arvika; spring-tooth-harrows from Överrum, Norrahammar and Kockum's; "slad"-harrows from Wiberg's in Ransta; drills from Västerås Farming Implements Co. and the Gävle Field-Implements Co., and the Överrum's and Ystad Factories; mowers from Överrum's, the Västerås Farming Implements Co. and the Arvika Factory; horse-rakes from Västerås Farming Implements Co., Katrineholm's and Överrum's Factories; threshing-machines from Munktell's in Eskilstuna and Thermænius' at Hallsberg; steam-locomobiles from Munktell's and petrol-motors from Svensson's Factory at Augustendal, Bolinder's in Stockholm, etc.

The introduction of public tests of implements has, in some degree, contributed to the improvement in the manufacture of implements, and to the enforced withdrawal from the market of goods of second-class workmanship.

As early as the seventies there commenced, in connection with the general agricultural meetings, practical testings of farming implements the object of which was to facilitate the judging. By means of a magnificent gift of the A.B. Separator in 1896, it became possible to establish regular implement-testing centres at Ultuna and Alnarp, at which agricultural high schools the work has since continued, being nowadays entirely supported by State grants.

Horticulture and Floriculture.

The area of the gardens and orchards of Sweden is reckoned for 1911 at 45 719 hectares, corresponding to about 1·25 % of the cultivated soil.

Until the eighties of the last century horticulture had been carried on mainly in the manor-houses, and with the object of supplying the proprietor with garden products. What was not consumed for the household was sold in the towns. At this time, however, people began to realize pretty generally the importance of horticulture as a branch of industry. The cultivation

of some particular plant or other was made a speciality, and this cultivation was carried on as intensively as possible. Market-gardens were laid out all over the country and in the course of the last twenty years, a large body of independent market gardeners has arisen in Sweden.

Kronoberg Park, Stockholm.

Pomology is without doubt the most important branch of Swedish gardening and is pursued with great intensity in certain parts of the country. According to the adaptability, as regards soil and climate, of the various districts for successful fruit-growing, the country has been divided into five zones. The first of these zones comprises Malmöhus län, and the coast districts of Halland, Kristianstad, Blekinge, and south Kalmar läns up to Mönsterås, as well as the islands of Gottland und Öland. The second zone includes the forest districts of Halland, Kristianstad, Blekinge, and south Kalmar läns, almost the whole of north Kalmar län, Östergötland, Bohuslän, parts of Västergötland, and the Mälar valley. The third zone comprises part of Småland, namely a narrow belt touching on the second zone, Dalsland, parts of Västergötland, the whole of Södermanland, and the south parts of Närke and Västmanland. The fourth zone includes almost the whole of Jönköping län, Värmland, and the north parts of Närke, Västmanland and Uppland. Finally, the fifth zone embraces south Dalarne and the coast region of Norrland.

In the first zone are cultivated mainly finer kinds of pears, such as Louise Bonne of Jersey, Doyenné du Comice, Doyenné Boussoch, Moltke, and William

pears, as well as two kinds of apples, Cox's Orange and Cox's Pomona. In Gottland is also cultivated the Stenkyrke apple, in Halland and in south Kalmar län, Gravenstein. In the second zone are produced, on the whole, the finest apples, particularly Gravenstein, the Akerö apple, and Yellow Richard. In the third zone the Akerö, Sävstaholm, and the Oranie apples predominate. In both the second and the third zone are also cultivated with success certain finer kinds of pears, such as the Fondante d'automne, Yat Yutte, and Moltke pears; in the second zone also Louise Bonne of Jersey, and William. These three are the fruitgrowing zones: in the fourth and fifth fruit-growing is of minor importance.

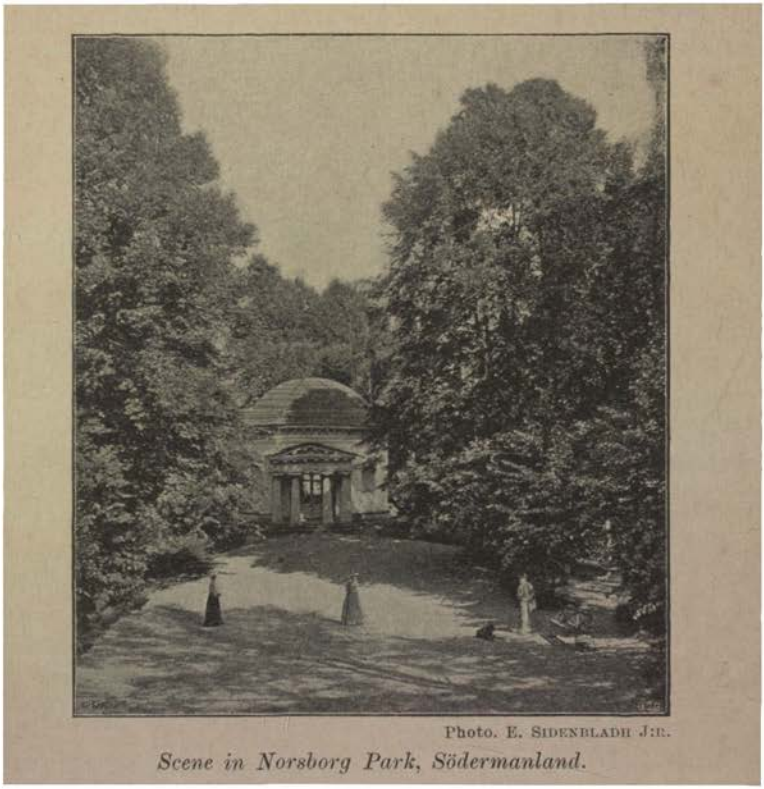


Photo. E. SIDENBLADH J:R.

Scene in Norsborg Park, Södermanland.

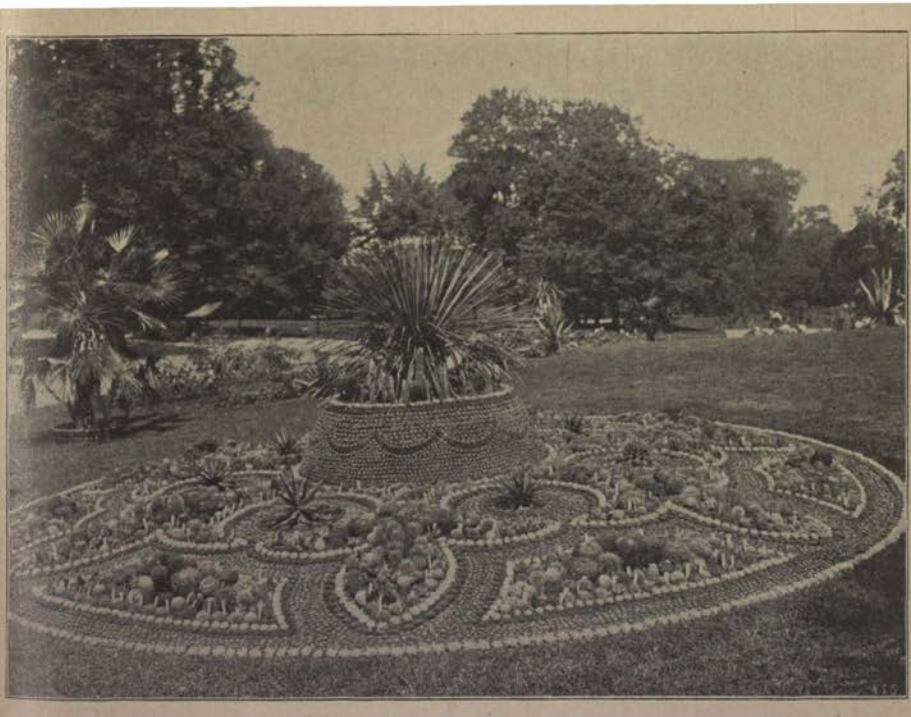
Within the three first zones a number of Fruit-growers' Associations strive to promote the cultivation of fruit. Each of these associations keep a "*träd skötare*", that is, a man whose business it is to do skilled gardening work in the orchards of the members; for this work he is paid according to a fixed rate. In certain läns, such as for instance in Södermanland, there are over 60 of these associations. In that län these associations are in turn amalgamated into one big Union, embracing the whole of the län; it has instituted several "fruit depots", that is, magazines to which the fruit-growers can send their fruit. The fruit is then sorted and packed, and sold through the agency of the superintendent of the depot. The Union also undertakes the purchase of materials required for the orchards.

In recent years fruit-drying establishments of the same kind as those in the United States have been erected in several places, and it is now only a question of time when Sweden will produce enough dried fruit to supply home needs.

Cherries and plums are cultivated to a considerable extent, particularly in

the first three zones. Gooseberries, currants, raspberries, and strawberries are grown almost all over Sweden. During the last few years, however, an epidemic fungus disease "the American gooseberry-mildew" has greatly hindered the cultivation of the chief kinds of berries. Peaches, apricots, walnuts, and mulberries can be successfully cultivated in the open only in certain parts of the first zone. Grapes and peaches, on the other hand, are pretty generally cultivated under glass.

Large orchards are pretty common. The largest are at Helmershus, Hälsingborg and Båstad in Skåne, Adelsnäs and Norrviken in Östergötland and at Eriksholm in Södermanland. The number of fruit-trees in each of these plantations varies between 3 000 and 6 000.



Groups of Cactuses in Humlegården Park, Stockholm.

Horticulture has, in consequence of the keen interest taken in fruit-growing and gardening in general, been carried up to a high standard during recent years. Notwithstanding that new nurseries have been laid out and the old ones considerably enlarged, the supply of garden products is at present rather scanty, so that import has become necessary, especially of certain articles, such as roses.

Floriculture under glass has been greatly developed, as is attested by the fact that, though the consumption of flowers has been increased many times over during the last twenty years, the Swedish floriculturalists as a whole are now able to cope with the domestic demand. At present hardly any other flowers are imported than carnations and roses during the months from December to February. The value of the whole import of flowers did not amount in 1913 to more than 171 616 kronor.

In the vicinity of the larger towns, particularly Stockholm, Gothenburg, Malmö, Norrköping, Lund, Sundsvall, very large blocks of greenhouses have been erected during the last few years. In certain places, such as, for instance, at Riddersvik near Stockholm, a large number of market-gardeners have settled; they carry on mainly floriculture under glass. Many of these floriculturalists have worked for several years in German, Belgian, or English market-gardens.

There are only a small number of public greenhouse establishments. The big and well-kept greenhouse establishment of the Trädgårdsförening at Gothenburg is considered to be one of the very best of its kind that any country can boast of.

Vegetable-growing is carried on all over the country both for household requirements and for sale. The largest kitchen gardens are found in the vicinity of Landskrona, Linköping, Norrköping and Enköping.

The public plantations of Sweden, can stand comparison with those of any other country. In all the larger Swedish towns there are public parks with flower plantations, usually extremely well kept, and often very expensive. In this respect the lead is taken by Stockholm, whose plantations have attracted deserved notice from strangers and foreigners. In 1913 the plantations of Stockholm cost 251 775 kronor. There are also celebrated public plantations in Gothenburg, Malmö, Gävle and Norrköping. The last-named town possesses the longest avenue of limes that any European town can boast of.

Neat and well-kept plantations have also been laid out at the railway stations.

Educational establishments for gardeners are found at Alnarp in Skåne, Adelsnäs in Östergötland, Experimentalfältet at Stockholm, and Härnösand in Norrland. The School at Alnarp is managed by the State, while that at Experimentalfältet belongs to the Academy of Agriculture. The two other establishments are private schools, but are subsidized by the State. All these schools have a two years' course. In order to obtain admission to any of these establishments, it is necessary to have had three years' practice in gardening. Instruction in gardening is also imparted at the Bergianska trädgården at Stockholm, though not to the same extent as in the other gardening schools. There are gardening schools intended exclusively for women at Espenäs in Närke and at Torshäll in Dalarne. Female pupils are, however, also admitted at Alnarp, Adelsnäs and Härnösand.

Four Government bursaries of 1 200 kronor each are awarded annually to persons who have passed through a State-aided gardening school and who desire to acquire abroad further training in gardening.

Gardeners' Unions are pretty numerous. The most important are Sveriges pomologiska förening, Sveriges handelsträdgårdsmästareförbund, Svenska trädskoleföreningen and Sveriges allmänna trädgårdsförbund, all of them embracing the whole country. There are, besides, local associations in all parts of Sweden. The most important of these are Stockholms gartnersällskap at Stockholm, Hortikulturens vänner and Västra Sveriges trädgårdsmannasällskap at Gothenburg, and Skånska trädgårdsföreningen at Malmö.

2. LIVE-STOCK.

In general, and the rearing of cattle and pigs in particular.

Since time immemorial, cattle-rearing has been the principal industry of Sweden. Even during the later Stone Age, the civilization that had been represented by hunters and fishers in the south and centre of Sweden had been obliged to make way for the megalithic agricultural civilization that was introduced by an Arian pastoral race — the primitive Germans — when these began to drive farther and farther to the north and east the earliest dwellers in Scandinavia, i. e. the race from which the Laplanders and the Finlanders of to-day are descended. This hunting and fishing race, which dwelt by the shores of lakes and waterways, had only one domestic animal, the dog; while the forefathers of the present Swedes — the invading primitive Germans — brought with them from the south domestic animals of various kinds, such as the horse, horned cattle, sheep, goats, and swine.

These animals throve in these northern climes and increased tremendously, so that, from the very beginning, their rearing became the very centre of the husbandry of Sweden, a position which it has retained to the present day. It is true that efforts have now and then been made to raise the cultivation of grain to this supremacy, but all the attempts made to displace the rearing of live stock from its premier position in Sweden have hitherto proved ineffectual.

In spite of its prominent position in the agricultural economy of the country, the live-stock industry in Sweden has had its periods of weakness, periods when it was neglected, when it was regarded as a necessary evil and injurious to the economic welfare of the country, but it has always recovered, and with renewed strength once more regained the proud position it formerly held.

Such a period of weakness occurred during the earlier Middle Ages, but, thanks to the interest which the monks, the Cistercians especially, devoted to the development of cattle-rearing, the results they obtained have never been surpassed until our own times.

On the next occasion when the industry was in peril, it was taken in hand by King Gustavus Vasa, the great "State Economist", who, by means of importing more vigorous foreign breeds, and by means of a well-arranged system of feeding, succeeded in once more raising the standard of the Swedish cattle. This improvement, which, in a great measure, was due to the king's own initiative and superintendence, lasted only until some few years after his death, Sweden then being swept by exterior forces into the vortex of lengthy wars, when the resources of the country had, for the most part, to be devoted to furthering Swedish interests abroad.

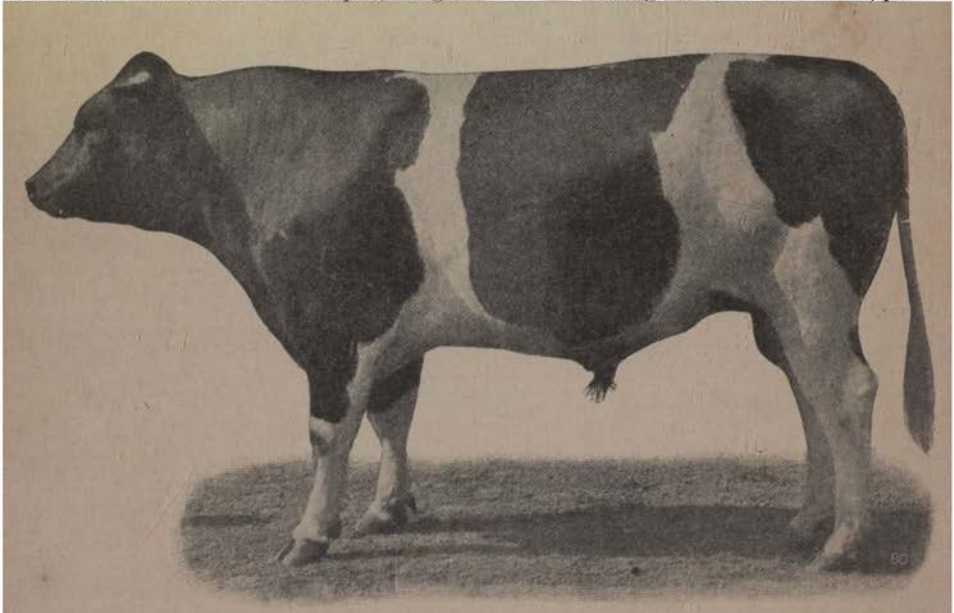
At the period of the death of Charles XII (1718), the cattle-rearing industry of Sweden was on the brink of ruin, but it was rescued during the "Period of

Liberty", as it was called (v. the section on the History of Sweden), by the energetic initiative of *Jonas Alströmer*. This prominent economist, like Gustavus Vasa, introduced foreign improved breeds of cattle into the kingdom, and he indicated the method by which the greater part of our existing stock of cattle is nowadays improved, for he recommended cross-breeding, and pointed out that the improvement of the breeds of cattle should be brought about "by crossing good sires with poor females".

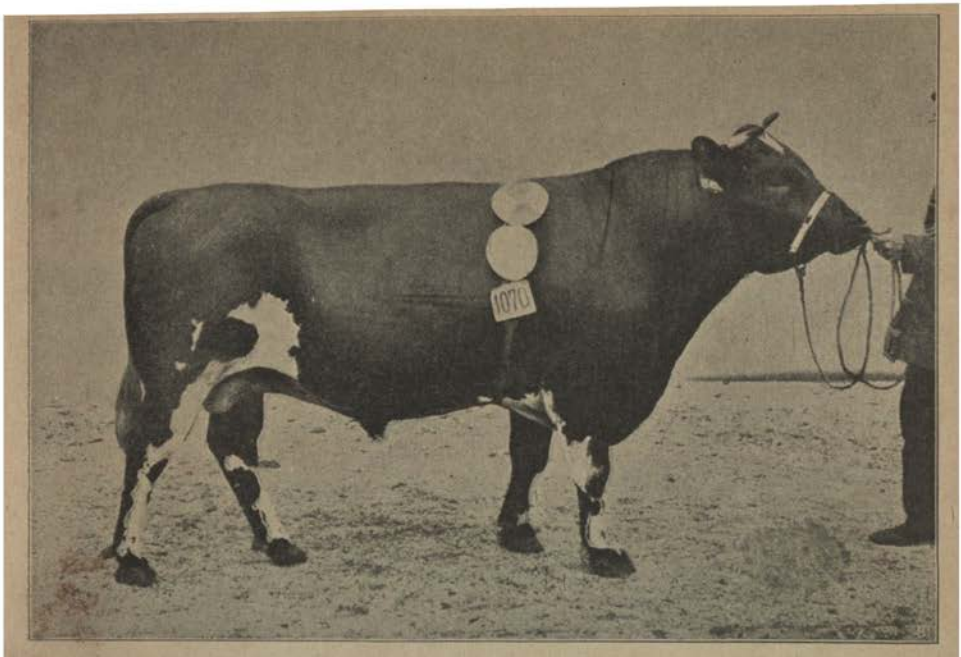
The efforts made during the "Period of Liberty" for the development of cattle-rearing were, it is true, crowned with success at first, but in the middle of the 18th century the cattle plague reached Sweden, and destroyed the farmers' hopes of better times. After the Alströmer period, cattle-rearing steadily declined, in spite of the fact that interest in efforts for the improvement of the industry seems to have awakened to fresh life during the reign of Gustavus III, when private initiative came to the fore, and, among other things, brought about the import of breeding-cattle from Holland, Denmark, and other countries.

The *Agricultural Societies* and the *Academy of Agriculture* (see pp. 142 and 122) at first met with great difficulties and could do very little to assist the cattle-rearing industry. During the years of warfare at the beginning of the 19th century, the economic position of the entire country was a very bad one, the country being brought to the brink of ruin and bankruptcy, so that, when peace was re-established, Sweden's economic position was in much the same position as it was at the death of Charles XII. Heavier animals of improved breeds were not considered suitable in consideration of the then existing condition of the country, but the import of such animals continued, although on a small scale.

During the decennium 1830—40, breeding cattle began to be imported in greater numbers, and thus commenced a new era in the history of Swedish cattle-rearing. The first steps were taken by a private individual, *Alexis Noring*, who, after several years' study of agriculture in England, succeeded in interesting many prominent Swedish land-owners in the procuring of better breeding-stock from abroad, prin-



Swedish Lowland Cattle (»Prince John», Arlöv).

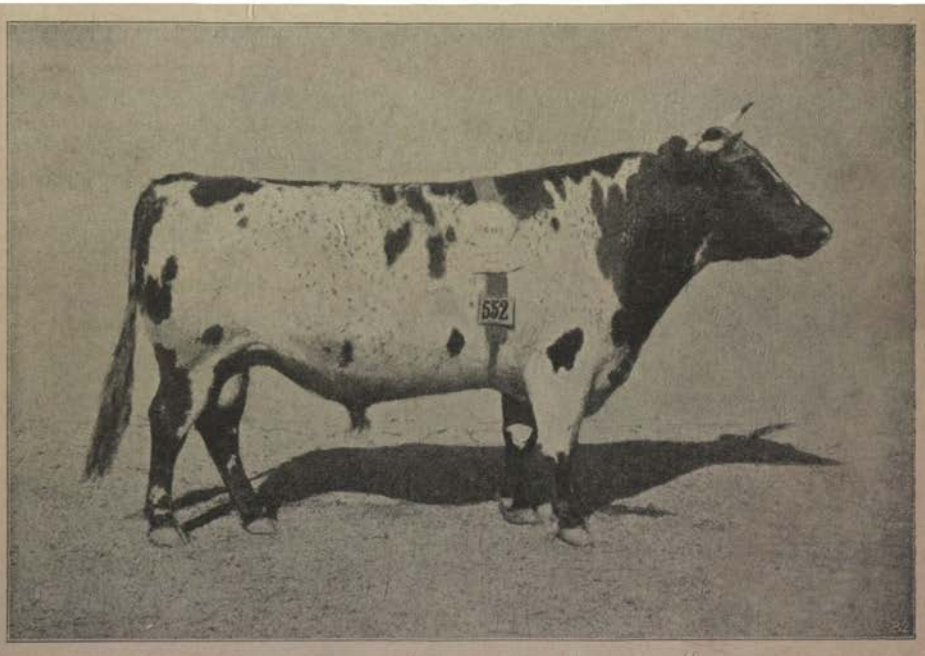


Red-and-White Swedish Cattle ("Hero", Edö, Askersund).

cipally from England. The results of these steps were so encouraging that, after the death of Noring, the State considered that it would be to its advantage to proceed in the same way. The State assembled central herds of cattle and flocks of sheep of several different breeds, all of foreign blood, from which the breeders should have the opportunity of procuring themselves improved breeding material. These herds and flocks were under the superintendence of the *Breeding-stock Board*, which was dissolved in 1871; after this date the superintendence of these establishments, together with the administration of the grants towards their maintenance was to be in the hands of the administrative committee of the Academy of Agriculture. Almost contemporaneously with this, the breeding herds of the State were dissolved and sold, with the exception of that of short-horned cattle at Alnarp, which continued to exist until 1901. The money obtained by the sale of the herds in question was made into a fund called the "breeding-stock fund". Later on, this was turned into a general fund obtained by the sale of the greater part of the breeding flocks, the whole being called *"the fund for the improvement of Swedish horned cattle and sheep"*, which, since the year 1890, has been administered by the Exchequer and the Board of Agriculture. The money is employed for the promotion of cattle and sheep-breeding.

Goats, too, were introduced into Sweden from abroad, but these animals have never occupied a place in agricultural economy comparable with that held by horned cattle or sheep. In earlier times, however, there was a considerably larger stock of goats than exists in our own days. As the forests rose in value, the number of goats decreased, as these animals, which are very difficult to keep within the limits of fenced fields, are the domestic animals that cause most injury to the young forest trees. Of late years, however, goat-rearing, in connection with the "Own Home" movement, has become the object of great interest and systematic development.

The import of breeding *pigs* took place mostly from England, the country which has been the principal foreign customer for fatted pigs and bacon from Sweden. In the middle of the decade 1860—70, the State took measures which enabled Swedish breeders to export their animals to English markets, and advantage was taken of this, especially by feeders in the southernmost provinces of the country, where the great supplies of waste products from the dairies had led to an overproduction of pigs. But in 1892 the English market was once more closed to the import of live animals, a measure that led to the establishment in Sweden of pig slaughter-houses, the object of which was the export of pork killed in the country. Pig-breeding, however, made no great progress in the country, before the beginning of the present century, at which date the great importance of the trade for the economy of the individual agriculturalist, and of the country as a whole, attracted the attention of the authorities.



Ayrshire Cattle ("Mogul-Ada II", Gimo bruk).

The place occupied by the breeding and feeding of pigs in the agricultural economy of Sweden has always varied in the different parts of the country. In the south of Sweden this branch of industry has long been one of importance. In former times, the pig had to turn the acorn harvest to account; in later days, it was the task of these animals to support the dairy-industry by turning dairy waste into pork. In those parts of the country where dairying has not been carried on on a large scale — chiefly in Norrland — pigs have been kept principally in order to utilize the waste products of the kitchen, and in such districts, consequently, the numbers have not been large enough to satisfy the home demand.

The chief among the general steps taken in our own days to promote live-stock breeding is the **awarding of prizes** for that purpose, a method

resorted to at present to improve the breeds of horses, horned cattle, sheep, and pigs. An account of the monetary awards given for horse-breeding is given on p. 94. As the giving af prizes for the breeding of *horned cattle* has attracted much and well-deserved attention, it may not be out of place to give here a somewhat detailed account of the manner in which it is carried out.

In 1882, the Skaraborg Agricultural Society adopted a system elaborated by Captain *Sigge Flach* for prize-competitions for cattle, which proved itself superior to all others by the way in which it attracted the generality of the small farmers to take part in the work of improving the breeds. Exceedingly simple in its plan, it is based on practical, well-considered principles, which is best shown by the fact that, even before the State had voted the slightest sum towards covering the expenses, Flach's system had been adopted with success by the districts of 17 different Agricultural Societies. In 1892, when the State for the first time made a grant, this figure at once rose to 25, and shortly afterwards, to 26, i. e., prize-competitions for cattle, according to the *Skaraborg System* (as it is now generally called), have been held annually in all the districts of the Agricultural Societies. In 1907, the number fell to 25, the Gävleborg Län Agricultural Society then determining to cease awarding prizes for cattle according to the system in question. Since the beginning of the year 1910, the amount of the State grant for the support of the prize-competitions for cattle has amounted to 120 000 kronor, 30 000 kronor of which was to be devoted to providing extra prizes for bulls belonging to the Bull Society. The sums mentioned amounted, however, to but a relatively small proportion of the entire expenses, which, in 1912, reached 362 309 kronor.

The aim of these prize-competitions for cattle is the creation of good breeds which are suited to the various parts of Sweden.

At present the system is employed for only five breeds of cattle, viz.:

1. The *Alpine race* (or North Swedish cattle) in Norrland and Dalarne, which is estimated to yield about 2 500 kilograms of milk, with a 3·80 % of fat. Live weight, about 350 kilograms.
2. *The Red Polled cattle* (Sw. Rödkullor), in Dalarne, Bohuslän, etc. The milk-production and live weight about the same as those of the first-named breed.
3. The *Ayrshire race,* in the south and middle of Sweden. Milk-production about 3 500 kilograms, with a 3·60 % of fat. Live weight about 450 kilograms.
4. The *Red-and-White Swedish cattle* of Central Sweden. Milk production (at Stjärnsund) about 4 000 kilograms, with about 3·80 % of fat. Live weight, about 500 kilograms.
5. The *Black-and-White Swedish Lowland cattle* of Southern Sweden. Yearly production of milk about 4 500 kilograms, with about 3·30 % of fat. Live weight, about 575 kilograms.

Hitherto, all these races have been bred principally for milk-production, but the milk-type is not so strongly marked but that the animals, in a greater or lesser degree, can be transformed into a meat-type, or a combined milk- and meat-type. The breeds that give quickest growth and which are easiest to fatten are the red-and-white Swedish, and the black-and-white Swedish

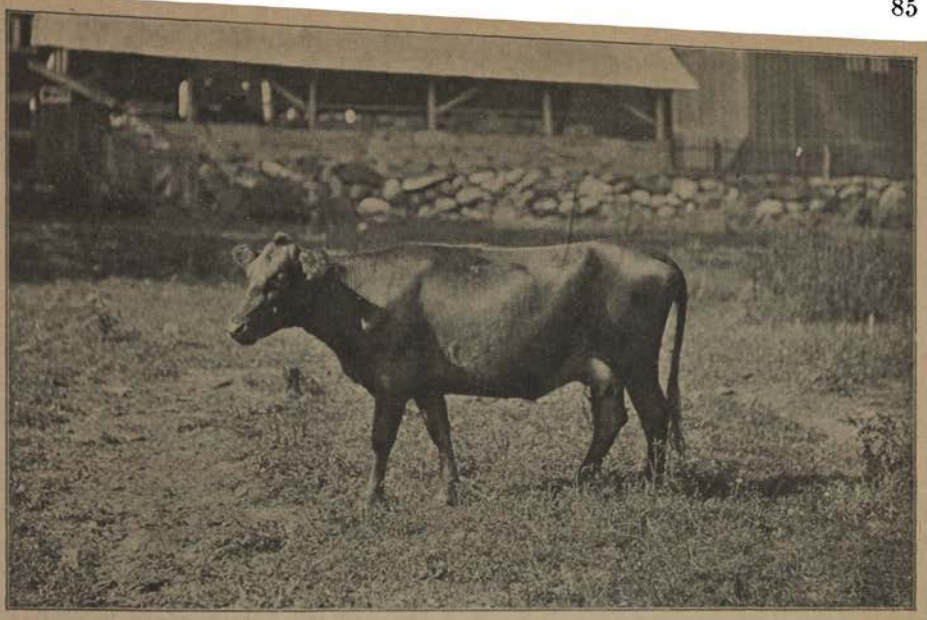
Swedish Alpine Cattle.

Lowland cattle. The figures given above showing the milk-production and the fat-percentage are no averages, but merely indicate what may normally be expected of the cows belonging to the respective breeds. On an average, the cows of the Swedish stock, taken as a whole, will scarcely yield on an average 2 000 kilogrammes of milk per year, with 3·50 % of fat, nor is the average live weight more than about 400 kilograms.

Each of the Agricultural Societies' districts forms a *prize-competition district*. The Agricultural Society, or its executive, determines each year in which places in the district the competition-meetings shall be held during the course of the year, and the tract of country which is entitled to take part in the competitions at each of these places. Each part of the prize-competition district is given the opportunity of taking part in the competition at least once every three years. Should the prize-competition not take place annually in the whole of the district, the Agricultural Society, if it sees fit, may arrange special prize-competitions for bulls within such parts of the district where, otherwise, there would be no prize-competition that year.

The prizes are awarded by a *jury*, consisting of a chairman and two other members. The chairman of each prize-competition district is appointed by the Board of Agriculture on the recommendation of the respective Agricultural Societies. The ordinary member of the jury who is to act at all the meetings in the district, is appointed by the executive of the Agricultural Society. The other member is nominated by the sub-division (Sw. gille, kretsavdelning, hushållningsnämnd, kontrakt) of the Society within the district, and acts only at the meetings held within the sub-district for which he has been elected.

As the number of prize-meeting places in each district is comparatively large, the various areas affected by the competitions become so very small that it is an easy matter for everyone to profit by the result of the prize-show and the judging.



Swedish Red-Polled Cattle (Bohuslän.)

The right of competing for every kind of *prize* is restricted to owners of cattle the total area of whose cultivated land does not exceed 40 hectares, and who carry on farming as their principal or chief auxiliary source of livelihood. The Board of Agriculture, however, can restrict the above right, so that it may benefit only those cattle-owners the total area of whose cultivated land does not exceed a certain area, smaller than the one just mentioned but not less than 20 hectares. Other owners of cattle are entitled to exhibit to the prize-jury both bulls and cows, though they can only be awarded prizes for the former animals and, even then, do not obtain money prizes. Cows are nowadays seldom awarded money-prizes, but usually receive only "free-tickets", of which two kinds are awarded: one a double-perforated free-ticket, the other a plain free-ticket. The former class of ticket consists of two parts, one a covering-ticket, and the other a covering-certificate. The covering-ticket, when the cow has been covered by a prize-bull, is given to the owner of the latter animal, and the second half of the ticket is kept by the owner of the cow. Both the covering-ticket and the covering-certificate are redeemed by the Agricultural Society for a sum and at a time fixed by the Society. The plain free-tickets consist of nothing but a covering-ticket, which is redeemed in the same way. The owners of the prize-bulls are awarded medals, cups, or monetary prizes of varying values or amount, according to the class of the animal, but there are also three kinds of extra prizes, viz., *breeding-prizes* for older bulls, *prizes of honour* for younger bulls, and *extra prizes* for bulls which are the property of bull-societies. Thanks to these prizes and to the covering-certificates, the bull-societies are able to manage without asking their members for any considerable contributions. The so-called "herd-prize" (Sw. flockpris), which is awarded at the prize-meetings for not less than 3 cows adjudged worthy of a prize, also contributes to this satisfactory result. At these exhibitions, too, every animal that gains a prize is branded with a mark, showing that it has been distinguished in this way; this branding can, in a way, also be considered

as a kind of prize, as in the event of the sale of such an animal, weight is often attached to its possession of such a mark.

After the close of the competition, one of the members of the prize-jury usually gives a short account of the meeting, at the same time offering advice and information respecting the breeding, rearing and care of cattle, etc. Such lectures, illustrated as they are by the living animals present at the show, have proved to be very effective. From this short account of the Swedish system of prize-competitions for cattle, it will be seen that an endeavour is being made by this means to benefit the small farmers and to awaken their interest in improved methods of cattle-breeding. A speaking witness to the lively interest that is taken in these prize-meetings is shown by the fact of the great increase each year in the number of animals exhibited. In 1912, there were exhibited 60 060 animals, 52 846 of which were "passed". Of this latter number, 14 406, or 24 %, were pure-bred animals; 3 246 were Ayrshires, 2 426 were of the Lowland race, and 6 795 belonged to the Alpine race.

This system of prize-competitions has undoubtedly contributed to the fact that especially the small farmers have gained an insight into the great importance for agriculture of the care of cattle. Everywhere in the kingdom the work that is carried on for the improvement of the various breeds is taken up with growing interest, and earnest endeavours are being made, by means of suitable feeding and rearing to obtain better milk- and meat-producing cattle. The farmers are everywhere of the opinion that the revenue of the farm is to be gained principally out of the farmyard, where a steadily increasing proportion of the crops is transformed into milk and meat, etc. By means of a rational system of cattle-breeding a considerable improvement has been made in the various breeds of cattle, and in other respects, too, the management of the farmyard seems to be the branch of agricultural economy that has made the greatest progress.

Prize-competitions for sheep have taken place since 1868 on the Island of Gottland, but nowhere else in Sweden. The rules for these competitions were issued on January 12, 1910, and have been in force since the beginning of 1911. According to these regulations, prizes for breeding-animals are for rams only, and meetings are to be held in five districts, viz., at some place in each of the parishes of Fårö, Lärbro, Roma, Eksta, and Öja. In spite of these prize-competitions, sheep-rearing has declined on the island, as it has on the mainland.

The breeding material employed for the Gottland sheep is the Cheviot ram, some of the sires being imported direct from Scotland, while others have been reared on the island. The breed in question has proved very suitable on the Swedish mainland, too, especially in Norrland and the central parts of the country. Some English races, too, such as the Oxfordshiredown, the Shropshire, and the Southdown, are employed in the southern and central parts of the country for the improvement of the stock. The merino breed, which during the 18th century was comparatively numerous in Sweden, is now represented by only a few hundred animals in Södermanland and Östergötland.

Goats have not yet received the encouragement of State-aided prize-competitions, but, in Skåne prize-meetings for goats are supported by a goat-breeding association which has been formed in that part of the

country. Of the goat races, the Jämtland and the Saanen goats are best suited to Swedish conditions. The last-named breed, which seems to be popular, especially in Skåne, has been imported on a fairly large scale.

Prize-competitions for pigs are also held nowadays, the first attempt in this direction for the promotion of pig-breeding having been made five years ago by one or two Agricultural Societies, which have since had many imitators, especially since 1911, when the State undertook the direction of these prize-competitions. Only two races can receive prizes, viz., the large white English race and the country race (Sw. lantrasen) — Swedish or Danish.

In addition to this system of prize-competitions, various kinds of **breeding socitiees** have largely contributed to the promotion of cattle-rearing. As regards the breeding of cattle, for example, most excellent work has been carried out in this direction by the "Swedish Ayrshire Society", founded in 1901, and the "Society for the breeding of Red-and-White Swedish cattle", which was established in 1892. Quite lately, a society has been formed for the breeding of red polled cattle, and another for the improvement of the Lowland cattle. A number of smaller societies, too, have been of great service to cattle-breeding, not the least useful being the so-called "Bull Societies", which have been strongly supported both by the State and the Agricultural Societies. The Agricultural Societies in the Läns of Uppsala, Gottland, Västernorrland, Jämtland, and Västerbotten have established stations for so-called "breeding-bulls", for which grants are made.

There are also a large number of breeding societies for sheep, goats, and pigs. In 1907 was established the "Swedish Pig-breeding Society", which embraces the whole of the country, and which has undoubtedly contributed to increasing the interest in pig-breeding.

The keeping of **herd-books** and the **auctions of breeding animals** have undoubtedly been of great service in the task of improving the breeds of cattle, etc. State herd-books are kept for Ayrshires, for the Alpine breed, and for pigs, while Agricultural Societies or other associations keep herd-books of the black-and-white Swedish Lowland cattle, the red-and-white Swedish cattle, the Ayrshires, the Alpine breed, goats, and pigs. The auctions of breeding animals held every year have essentially facilitated the procuring of prominent sires. Such auctions have been held at Malmö since 1900, on the initiative of the Prize-Juries of the Läns of Malmöhus and Kristianstad; at Jönköping, Linköping, and Skövde, since 1903, on the initiative of the Swedish Ayrshire Society; at Flen, since 1903, by the Society for the breeding of red-and-white Swedish cattle, and at Östersund, since 1908, by the Prize-Jury of Jämtland Län.

Among other measures that have been taken for the promotion of the breeding of cattle may be mentioned the competitions arranged by the State for the establishment of **breeding-centres** for horned cattle; the grants given by the State to pig-breeding societies and **pig-breeding**

centres; the Control Associations; the Veterinary System; and the Educational System for Agriculturalists.

At the *competitions for the breeding centres,* which are managed by special juries, distinction is awarded as breeding centres to such herds as consist of prominent animals which are capable of transmitting their good qualities to their offspring, and which also possess other characteristics proving that they can contribute in an essential degree to the improvement of the breeds of cattle. The two competitions that have hitherto been held, each of which lasted two years, included herds of Ayrshires, black-and-white Lowland cattle, and Alpine cattle, while, in that which is now going on, there are no representatives of the Lowland breed. The distinction of being nominated as a breeding centre holds good for a period of three years, during which time the various centres remain under the control of the respective breeding-centre juries.

In order to promote the establishment of pig-breeding societies, the State contributes a grant towards covering the expenses, the grant in question being so calculated that it ought to be an effective help towards the procuring of boars by the societies. The additional support of which the society and its members may be in need for the payment of their annual expenses is not given in the shape of a yearly contribution, but only in the form of prizes to be awarded at the prize-competitions; the object of these is to show that the breeding work done by the society is based on correct principles and that it is carried on satisfactorily. As it is also a matter of importance for these societies to have, from the very beginning, breeding animals whose offspring will give pork that can fetch the highest price in the markets of the world — boars of the large, white English breed and sows of the "country" breed (Sw. lantras) — the State also contributes to support the various kinds of breeding centres from which it will be possible to obtain the breeding animals that are required.

The *Control Associations* have been of inestimable assistance in the measures taken for the promotion of breeding, as their chief task has been to investigate the individual productive powers of the animals, though the societies in question have also had other important missions to fulfil. Among other things, it has been their task to spread a knowledge of, and to carry out, a rational system of feeding, and, if possible, to draw up estimates of the economy of the cow-house and the pig-sty, etc.

An account of the *veterinary system of Sweden* is given in another place, so that it is not necessary here to do more than emphasize its great importance in the task of combating infectious cattle-diseases, especially tuberculosis.

The Swedish *system of instruction in agricultural subjects* has exercised a very great influence on the development of live-stock rearing. Capable men have been sent out from the Swedish schools of agriculture, who have afterwards, as experimentalists, experts, teachers, or practical farm-

TABLE 24. *Number of Live-Stock, in 1911.*

Horses above 3 years	Horses under 3 years	Oxen	Bulls	Cows	Young cattle under 2 years	Sheep	Goats	Pigs	Reindeer
493 322	95 163	144 277	52 467	1 837 035	655 830	945 709	66 136	951 164	276 084

ers, spread information concerning breeding and the economy of the farm-yard. The *experimental department* is centralized at the Experimental-fältet, in the immediate neighbourhood of Stockholm, and possesses a special division for live-stock husbandry, which, up to the present, has been occupied with a number of important questions concerning the feeding of cattle, horses, and pigs. The State has appointed three experts in the live-stock industry, viz., one for horned cattle, one for sheep and goats, and one for pigs. In each of the läns of Sweden there is, too, at least one expert appointed by the Agricultural Society of the district, who, among other things, endeavours to improve the breeding of cattle. In addition to the teaching given in the Agricultural Schools and the Farmers' Schools, instruction in live-stock husbandry is given in schools for farm-yard hands, at courses for control assistants, at courses for small farmers, etc.

The total number of *live-stock*, and of the various kinds of these domestic animals existing in Sweden in 1911, is shown by Table 24, which, together with the other figures given below, has been obtained from the summary published by the Central Bureau of Statistics.

The total number of animals at the close of 1911 was 5 241 103. This amounted to 942 per 1 000 inhabitants, as compared with 972 in 1910, 959 in 1905, 1 025 in 1900, 1 061 in 1895, 1 038 in 1890, 1 048 in 1885, 1 024 in 1880, and 1 072 in 1870. On the whole, therefore, the proportion has become less satisfactory. The decline proceeded from the middle of the decade 1891—1900, but the position has improved during the last few years. As regards the numbers of the various classes of animals in proportion to the population, and the development which, in this respect, has characterized the last four decades, investigations show that the relative numbers of horses, bulls, and young cattle has remained fairly stationary during the whole of the period. A very large decrease may be noticed, on the contrary, in the case of oxen, sheep, and goats. Nowadays, oxen are found most numerously in Östergötland and Småland, and goats in Norrland — Jämtland especially. Among the classes of animals that have increased more rapidly than the population during the last forty years are cows and pigs, the last-named especially, the relative figures for which have more than doubled during the period in question, but even in regard to these two classes of animals, the figures bear witness to the fact that, during the last fifteen years, the development mentioned has ceased, and, in the case of the cows, has been replaced by a relative decline. In these calculations, consideration might be paid to numbers alone, but all authorities on the subject agree that the quality of the animals, of the horned cattle especially, has improved. Contemporaneously with the improvement in the breeding of the live-stock that has taken place, greater attention has been paid to the care of the animals, and, more especially, to the feeding of the stock, thanks to the increased cultivation of fodder-plants and the larger import of oil-cake and other foods.

In order to obtain a better survey of the whole, it has been customary in statistics to reduce the live-stock of the country to "*cattle-units*". This reduc-

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tion is made so that 1 head of horned cattle is estimated as = $^2/_3$ horse = 10 sheep = 12 goats = 4 pigs = 5 reindeer. In addition, 2 foals or calves are calculated as being equal to one full-grown animal of the same kind. If we employ this method of calculation, we obtain the following figures for 1911, for the year immediately preceding it, and also for the last years in the quinquennial periods back to 1860—65:

Year	Cattle-units	Per 1 000 inhabitants	Per 1 000 hectares of: the total area	cultivated land and meadow
1911	3 566 140	641	87	708
1910	3 617 472	655	88	720
1905	3 406 961	643	83	674
1900	3 429 217	668	83	679
1895	3 367 999	685	82	673
1890	3 183 816	665	78	632
1885	3 093 955	661	76	626
1880	2 891 100	633	71	594
1875	2 863 006	653	70	613
1870	2 622 176	629	65	578
1865	2 591 037	630	65	608

As may be seen above, the increase in the number of cattle-units has continued throughout all the five-yearly periods, with the exception of the last but one, the period 1901—05. The relation of these figures to the area has been thereby so improved that, in 1910, it was more satisfactory than at the close of any of the previous periods, both as regards the total area of the country and also in respect to that of the cultivated land and pasture. It was natural that there should have been a considerable decline in 1911, as there was an unfavourable fodder harvest that year.

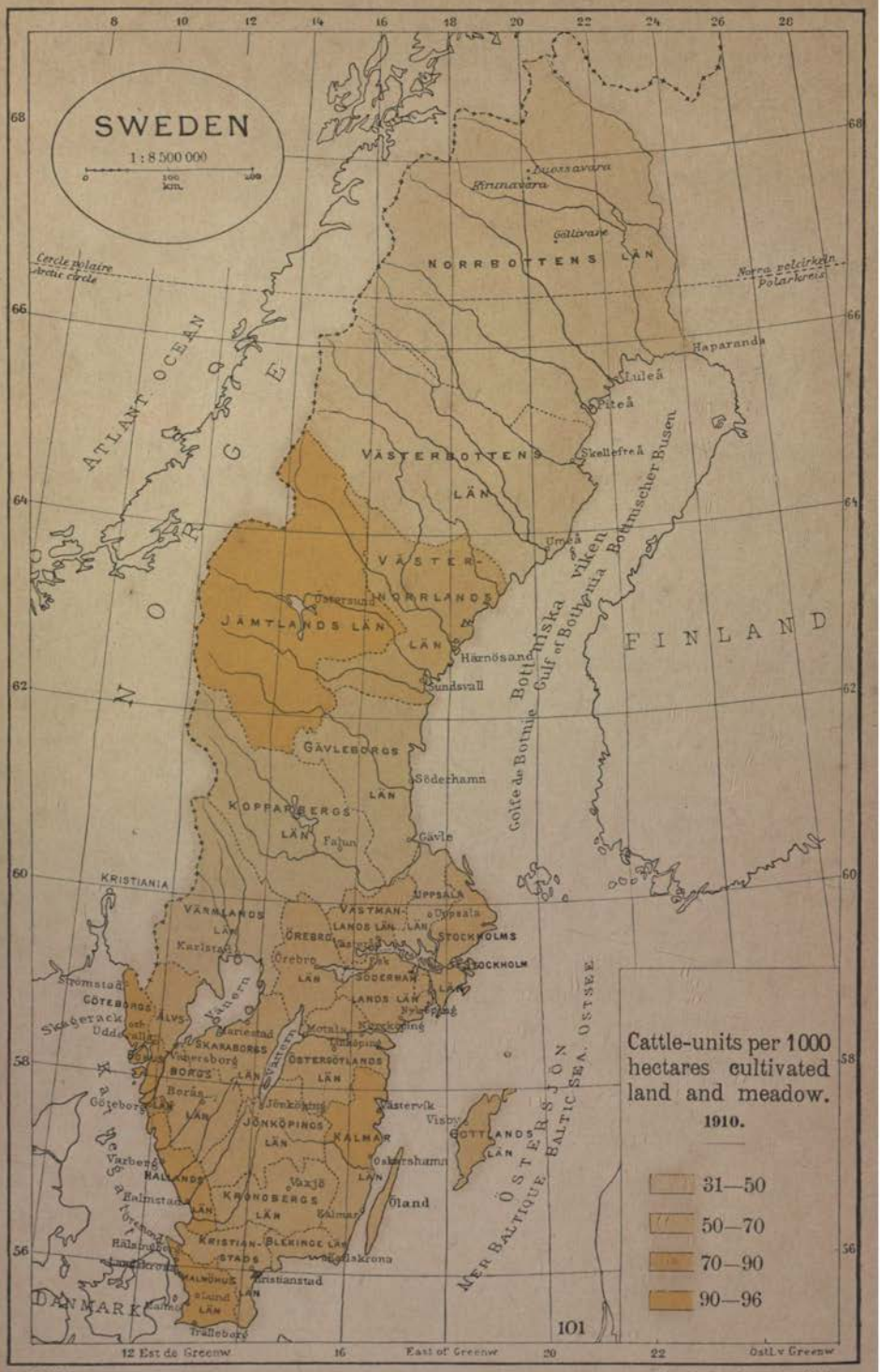
That the number of the live-stock must be reduced during bad fodder years can be best understood, if we remember how much such a year costs the country in "support fodder" i. e., the food that is required merely to support life, and, consequently, apart from the cost of the "production fodder", or that extra supply of food stuffs, from which milk, meat, and draught-power is produced. The cost of this support fodder probably amounts to about one million kronor daily, or, if we disregard the value of the grazing fields, to about 300 million kronor per annum. With these figures before our eyes, we cannot be surprised that the State has found it true economy to devote money to measures to lead the cattle-rearing industry into the right track.

Of all the läns of the country, that of Malmöhus possesses the largest and, from a qualitative point of view, the foremost stock of cattle, and is, consequently, as regards live-stock husbandry, the most important of Swedish läns, although far from being so with regard to the production of grain and root-crops. Next to Malmöhus Län, both in respect of live-stock and of the grain- and root-crops, come the läns of Skaraborg, Kristianstad, and Östergötland.

As regards the relation of the number of live-stock to the total area of cultivated land and meadows, the läns of Kalmar, Malmöhus, Göteborg och Bohus, Jämtland, and Västernorrland, boast very favourable figures. The lowest places in this respect are held by the Läns of Värmland, Kopparberg, and, particularly, Norrbotten and Västerbotten.

Table 25 is given to illustrate the position of live-stock in Sweden, as regards the imports and exports of farm-yard products and the like.

The later years were distinguished by a marked improvement with regard to the export of farm-yard products. This improvement was most pronounced in 1911, above all in respect to the trade in live-stock, meat, and pork.


SWEDEN
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200
Cercle polaire
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JÄMTLANDS LÄN
GÄVLEBORGS LÄN
KOPPARBERGS LÄN
VÄRMLANDS LÄN
VÄSTMANLANDS LÄN
ÖREBRO LÄN
STOCKHOLMS LÄN
SÖDERMANLANDS LÄN
UPPSALA LÄN
GÖTEBORGS OCH BOHUS LÄN
ALVSBORGS LÄN
SKARABORGS LÄN
ÖSTERGÖTLANDS LÄN
JÖNKÖPINGS LÄN
KRONOBERGS LÄN
KALMAR LÄN
GOTTLANDS LÄN
HALLANDS LÄN
KRISTIANSTADS LÄN
MALMÖHUS LÄN
BLEKINGE LÄN
Öland
Gotland
Haparanda
Luleå
Piteå
Skellefteå
Umeå
Örnsköldsvik
Härnösand
Sundsvall
Söderhamn
Gävle
Falun
Karlstad
Örebro
Stockholm
Uppsala
Strömstad
Göteborg
Borås
Jönköping
Västervik
Visby
Oskarshamn
Växjö
Kalmar
Karlskrona
Varberg
Halmstad
Helsingborg
Kristianstad
Ystad
Trelleborg
Landskrona
Malmö
Lund
Hässleholm
Kristianstad
Karlskrona
Kristianstad
Malmö
Trelleborg
Ystad

Farmyard of an Estate in Central Sweden.

As the import of pork into Sweden has considerably diminished, and as pork from abroad is consumed chiefly in the central and northern parts of the country, it would seem as if pig-breeding and the production of pork had gained ground more and more in these parts of the kingdom. Skåne, however, is the chief

TABLE 25. *Imports and Exports of Farm-yard Products and the like.*

		Imports			Exports		
		1908	1912	1913	1908	1912	1913
Horses . . .	Head	1 953	2 224	2 431	3 991	6 803	6 837
Cattle	»	4 817	2 806	2 891	9 767	34 349	42 254
Sheep	»	91	141	134	1 753	2 087	2 395
Pigs	Kilograms	6 528	5 358	5 428	10 126	199 404	463 313
Meat	»	2 435 469	1 851 356	2 013 633	622 843	8 699 995	4 917 852
Pork	»	4 614 045	1 522 805	2 613 728	2 783 772	11 463 741	7 908 593
Cheese . . .	»	365 476	580 211	550 557	2 096	5 430	2 742
Butter . . .	»	125 023	123 885	195 986	157 629	21 236 722	19 654 318
Margarine . .	»	2 735	147 829	367 622	461 763	22 141	16 473
Suet	»	2 215 569	869 066	802 877	49 805	14 895	10 569
Tallow . . .	»	6 206 353	3 071 261	3 791 500	805 724	605 350	535 350
Hides: raw .	»	7 715 993	11 973 919	12 998 856	6 766 139	11 434 765	10 689 998
» dressed	»	690 356	991 943	1 134 122	193 731	123 206	122 589
Bone and bone-meal . . .	»	8 943 354	6 430 278	6 131 384	30 464	1 063 435	1 493 422
Wool	»	5 579 567	6 623 749	5 945 388	32 315	61 820	75 856
Honey . . .	»	69 070	18 687	18 663	624	143	286
Wax	»	19 981	31 327	42 333	5 304	1 158	2 284
Eggs . . .	Total number	55 876 176	54 915 386	50 030 500	38 837 492	44 759 409	55 137 148

seat of the pig-breeding industry, and large quantities of pork are sent from that province to Stockholm and Norrland.

It is evident that the relation of Swedish trade with other countries, as regards the imports and exports of farm-yard products, etc., is very favourable to Sweden, but the question arises whether this position has not been attained at the expense of the individual farmer, for attempts have been made to show that the rearing of live-stock in Sweden is not a profitable occupation, as regards cattle and sheep, at least. It is difficult to decide whether this statement is in strict agreement with the facts of the case, but it is clear to the experienced and capable farmer that live-stock husbandry can be made a profitable employment, and on a large number of estates it is carried on at a profit. Among the factors that diminish the returns of this branch of industry are poor grazing, the cultivation of fodder stuffs on exhausted land, the keeping of live-stock of poor quality, neglect of the stable manure problem, the low prices obtained for milk and meat, the high value of land, lack of business capital, high freight charges, high prices for concentrated foods, infectious or contagious diseases, the want of interest in the work shown by those in charge of the cattle, and last, but not least, bad management. The individual farmer can improve the pastures, can make the land more suitable for the cultivation of fodder stuffs, can turn the manure to good account, can improve the quality of the cattle, can interest the farm-yard hands in their work, can increase his own knowledge of cattle-rearing etc., but he cannot lower the price of land, nor do much to affect the prices of milk, meat, and concentrated foods, etc.

Horses.

At the end of the 16th century, Sweden possessed about 200 horses to every thousand of the population, a number which in 1805 had fallen to about 160, and in 1870 to as low as 103. But since that time the decline has ceased, so that in 1900 there were still 103 horses to every thousand of the population; indeed, a slight increase has been observable in recent years: in 1905, there were 105, and in 1910, 106 horses to every thousand inhabitants.

The total number of horses in Sweden at the end of the year 1911 amounted to 588 485. Relatively, the greatest number of horses are found in Skåne and Uppland.

The number of horses in Sweden, as compared with other European and some extra-European countries, is shown by the following table (about 1910):

	Number of horses per thousand inhabitants	Number of horses per sq. km
Sweden	106	1·3
Belgium	43·9	9·2
Denmark	206	11·3
Germany	78	7·4
England	53·2	6·5
France	75·6	5·4
Holland	57·6	8·2
Italy	23	2·5
Norway	75·4	0·5
Austria	63	5·2
Hungary	128·5	7·0
Russia (European Russia incl. Finland)	211·6	3·9

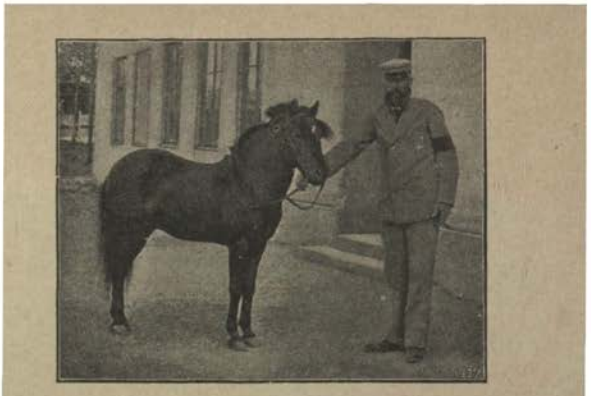
	Number of horses per thousand inhabitants	Number of horses per sq. km
Spain	21·5	0·8
United States	205·3	1·5
Argentina	1 034·2	1·6
Japan	35·8	3·7
Australia	397·5	0·24

We shall now proceed to give a brief sketch of the *history* of horse-breeding in Sweden.

Horse of North Swedish Breed.

In the earliest times there existed in Sweden a horse of small size. This type, the origin of which is unknown, has disappeared in consequence of crossing with several breeds introduced into the country during the course of time. Such a cross-breeding is supposed to have taken place with imported horses as early as during the Viking Period, when intercourse with foreign countries was rather brisk, this crossing becoming still more general when, with the development of chivalry during the Middle Ages, the need of a more powerful and stronger horse made itself felt. The returning knights brought home with them horses both from the East and from Western Europe, and these horses affected the type in the districts where they were used for breeding. On manorial estates and abbey lands, horse-breeding was pursued with keen interest. A statute of the year 1345 gives us a notion of the value of a really good horse at that time. According to that statute, a horse, in order to be considered suitable for knight-service, must be worth 40 marks (corresponding to about 2 800 kronor in present money value).

As far as we know, it was during the period of King Gustavus I that steps were first taken on the part of the Government for the improvement of horse-breeding. He instituted studs of mares and even riding-schools in the recently founded royal demesnes, where he placed Frisian horses he had purchased. During the following centuries Sweden was engaged in many wars, and in the course of them a great number of horses of different kinds were brought home. Horses were also received as gifts, and purchased by kings and representatives of the nobility. However, the common Swedish horse apparently still remained insignificant in size; in the seventeenth century a full-sized remount was only 138 cm high.



Gottland Pony ("Russ").

From time to time prescriptions were issued for the regulation and improvement of horse-breeding. Thus in 1680, it was prescribed that a stallion should be kept in each parish, and in 1692, that there should be one stallion to each squadron of cavalry; in 1694, the export of horses from Skåne was totally prohibited. But in spite of these and similar measures, the Swedish horse at the commencement of the 19th century did not come up to the requirements of the time. Larger and more thorough-bred saddle-horses and carriage-horses were needed. For this purpose a considerable number of English thorough-breds and Oriental horses were imported during the first half of the 19th century. Some of these proved very valuable for breeding, others worthless. During the latter part of the century a number of thorough-breds still continued to be imported, but there was an increasing tendency to employ foreign half-breds (Prussian, Hanoverian, Oldenburgian, Anglo-Norman).

The remarkable development of Swedish agriculture which commenced in the middle eighties necessitated an improvement in the ordinary farm-horse; particularly the horses of the flat districts in the centre and south of Sweden proved too small and delicate for the new agricultural implements and deep-soil work. In order to give the Swedish farm-horse greater bulk and strength, heavy draught-horses were imported from abroad and crossed with the Swedish farm-horse; the chief breeds employed for this purpose are the Clydesdale, the Percheron, and the Pinzgauer, as well as Norwegian and Belgian horses; the two latter races have been, and still are, of particular importance in Swedish horse-breeding.

Endeavours were first directed to producing a horse suitable for all-round purposes, but after a time specialization became necessary. The last fifty years of the 19th century must be regarded as a period of experiment, of casting about for suitable types.

Sweden requires light and heavy farm-horses, carriage-horses, and saddle-horses for the army.

For these purposes suitable types of horses are bred, and ponies, too, though only to a small extent. The different species of breeding may be classified as follows: *breeding of thorough-breds and half-breds*, or warmblooded horses, *breeding of farm-horses and draught-horses*, or cold-blooded horses, and *breeding of ponies.*

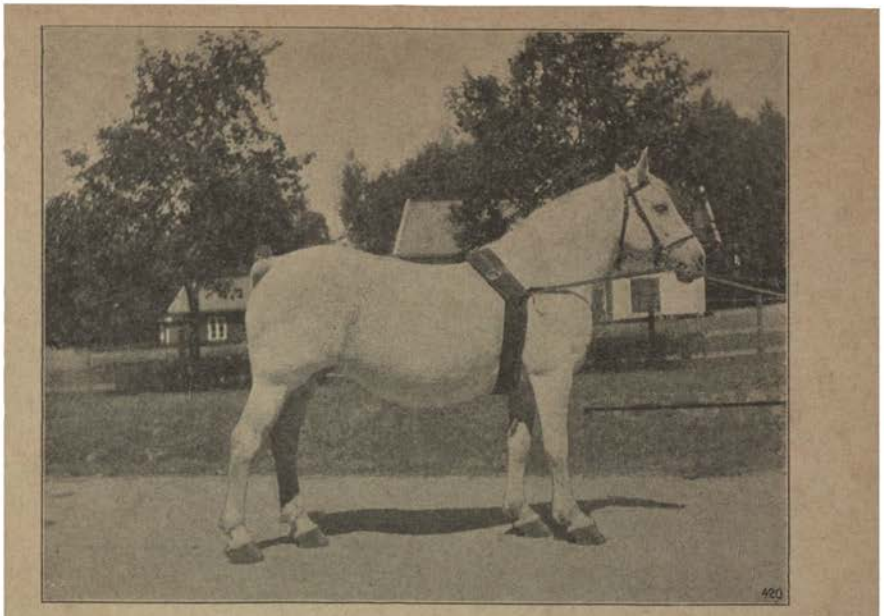
Breeding of thorough-breds and half-breds. Only a small number of thorough-bred horses are bred, and these almost exclusively from English stallions. Horses of finer race are used chiefly in the army, and stallions are maintained for this purpose by the Government. There are two principal Government depots: *Flyinge* in Skåne, and *Strömsholm* in Västmanland. In 1912, there were 153 stallions (inclusive of three-year-olds) at Flyinge, and 80 at Strömsholm. Only twenty of them are English thorough-breds, the great majority are Hanoverian, and the remainder Prussian horses. With only a few exceptions, the thorough-breds are imported as mature stud-horses. A small number of the half-bred stallions are born and reared in Sweden, the rest are imported as colts and reared at Flyinge. From the Government depots the stallions are sent out to about a hundred different stations during the covering period; only a few of them remain at the depot. In 1912, about 25 mares were covered by each stallion.

Skåne Half-bred.

Sweden also breeds half-breds of heavier types, suitable for heavy carriage-horses, and also for farm-horses. They are as a rule of a heavier Hanoverian or Oldenburgian strains. Stallions of such heavier types are to be found both at the Government depots and in private studs.

Among the measures of the Government for the encouragement of horse-breeding may be noted the award of "*breeding prizes*" at races, and of *premiums* (see below).

A number of *Societies* devote themselves exclusively to fostering the breeding



Västergötland Horse of the Ardennes type.

of light horses. others, such as the Swedish Jockey Club and the Skånska Fältrittklubben, have that object as an essential part of their programme.

The breeding of light horses stands highest by far in Skåne. The great majority of army horses are still purchased from Skåne, though latterly the tendency has been to take them more and more from the central parts of Sweden. Out of 1 051 remounts purchased in 1906, 64·8 % came from Skåne, and the remaining 35·2 % from the rest of the country; in 1911, the corresponding figures were 57·5 and 42·5 %. A small number of army-horses have been exported in recent years from Skåne to Denmark.

The Swedish half-bred, the army saddle-horse particularly, is an excellent horse. Unfortunately, the interest in the breeding of half-breds is manifestly on the decline. The reason is that the breeding of half-breds is at present considered less remunerative than that of draught-horses. It should also be noted that bookmaking is prohibited in Sweden, and this naturally discourages horse-racing. Proposals have been mooted to promote the breeding of light horses by abolishing this prohibition, and also by erecting a Government stud.

Native horses of the farm-horse type. There are parts of Sweden where the horses are sufficiently unaffected by foreign breeds to be considered pure natives. There is, for instance, the *Dalbo horse* in Dalsland and the north of Bohuslän, a small horse, but powerful for its size, and capable of much endurance and adapted for the more barren parts of the country.

There is also the "*North Swedish*" *horse*, descended from the Jämtland and Hälsinge horses. It is a powerful and very willing horse, of a light cart-horse type, draws the heaviest loads over roads, and trots briskly along the highways. It is quite indispensable for forest and highway work in the northern and central parts of Sweden, and moreover does capitally as a farm-horse in upland districts all over the country. It could doubtless also be used with advantage for the army, in the artillery and baggage department. For some twenty years, systematic efforts have been made with great success to preserve this invaluable

horse, which was becoming extinct through injudicious crossings with foreign stallions. (See "Stambok över nordsvenska hästar" by Wilhelm Hallander.) Closely allied to this native race is the Norwegian *Gudbrandsdal horse*, which is also used for inter-breeding with the North Swedish horse. The latter, as the name implies, is employed mostly in the north of Sweden, but this light, agile horse is finding its way more and more to the Midlands and the South, for farm and highway work.

The *Rearing Depôt for North Swedish Stallions* at Vångeu in Jämtland, erected on Crown property, and maintained by the Norrland Agricultural Societies, will doubtless do much to promote the breeding of the North Swedish horse.

The breeding of heavy draught-horses. Of the heavy breeds that have been imported, Percheron and Pinzgauer breeds have not appreciably influenced the breeding of the Swedish cart-horse. The *Clydesdale* horse was introduced into Västergötland as early as 1840 and gave rise to the "*Levene*" strain. It has also influenced the breed in other parts, particularly in the beet-growing districts of Skåne. This big, strong, agile draught-horse should be well adapted for these regions; nevertheless it is not particularly in favour at present, doubtless because it is more expensive to keep than its rival, the Belgian horse.

At the beginning of the seventies, *Belgian* horses of the Ardennes type began to be imported. The result was favourable; the Belgian, when crossed with country horses, produced a capital cart-horse, powerful and not too exacting. Consequently, the Ardennes horse has gradually been rising into favour, and, where heavy draught-horse breeding is pursued, it is the predominating type. Excellent Ardennes horses are reared in Västergötland, Östergötland, and Halland. Västergötland takes the lead: it not merely produces horses for its own requirements, but also sells a fair number to other parts of Sweden and to foreign countries, principally Germany.

The Ardennes horse is, as the name implies, an upland horse, of compact, powerful form, and lively movement.

Not all the horses which have passed under that name have been genuine

Colts in a Paddock at Vångeu.

Ardennes. That designation has been frequently applied to those imported from the lowlands of Belgium, big animals, but flabby and sluggish, and thus less valuable for breeding. In certain parts, this horse seems to be actually preferred to the genuine Ardennes, on account of its bulk and size.

In 1901, there was formed an Association the object of which is, by dint of keeping systematic records of pedigree, to preserve and utilize suitable breeding-horses of pure, or substantially pure, Ardennes race, and of good uniform type, and, by other measures as well, to encourage the breeding of the Ardennes horse in Sweden (Stamboksföreningen för svenska ardennerhästar).

Out of the hundred or so Stallion and Horse Breeding Societies in Sweden, 70 % as their object breeding with horses of the Ardennes type.

Pony breeding. On the island of Gottland there formerly existed a large number of small horses, called "russ", but since the separate re-partition of the land (Sw. enskifte; cf. p. 31), they have been gradually disappearing. The breed still exists, but in small numbers, which are being rapidly reduced year by year; thus this extremely hardy, enduring, and unpretentious pony seems destined to extinction. The demand for ponies in Sweden is supplied by the importation of Iceland horses, a less attractive breed than the dainty Swedish pony-horse.

Studs. Flyinge and Strömsholm, as well as Ottenby on Öland, were formerly Government studs. But at present there exists no Government stud. Strömsholm (in 1872), Flyinge (in 1887) were converted into stallion depots, and the Ottenby stud was in 1886 turned into a remount depot, now abandoned. A number of persons interested in horse-breeding have latterly urged the re-establishment of a Government stud for light horses at Ottenby.

There are private studs at Vittskövle in Skåne and at Loddby in Östergötland, for thorough-breds and half-breds; at Blomberg in Västergötland and Bjärka-Säby in Östergötland, for Ardennes horses. Mr Hjalmar Törnqvist's stud at Husby Gård in Uppland merits special mention, for his energetic and well-directed efforts to revive the old Hälsinge horse.

Premiums. The award of premiums for horses is provided for by a royal ordinance of the year 1913. For this purpose the country is divided into 6 districts, and each district into sub-districts. Each Provincial Agricultural Society constitutes a sub-district. Only the following kinds of horses are entitled to premiums:

1) Thorough-breds and half-breds.
2) Draught-horses of the following kinds:
   a) North Swedish and the Gudbrandsdal race or breed.
   b) Ardennes, and horses of that breed.
   c) Clydesdale, and horses of that breed.

Thorough-breds and half-breds are entitled to premiums all over Sweden; as to the other races, the Agricultural Society proposes, and the Studs Board decides which of them shall be entitled to premiums within a sub-district. Horses of the Gottland race are entitled to a premium, being reckoned as half-bred.

The grants made in 1914 for premiums amounted to 155 158 kronor from the Government, 151 700 kronor from the Agricultural Societies, and 16 950 kronor from the *landstings* (County Councils).

The Agricultural Societies endeavour to encourage horse-breeding in other ways as well. Thus some of them grant subsidies to Stallion and Breeding Societies for the purchase of suitable breeding animals; and the horse-shows arranged by them makes it possible to obtain a general view of the condition of horse-breeding in different parts of the country.

Annual horse-shows are held in Stockholm, Malmö, and Norrköping, in the spring.

The superintendence of horse-breeding devolves on the *Studs Board*, consisting of a president, two members, and a secretary; its head-quarters are at Stockholm.

Except for the need of a number of breeders, Sweden produces sufficient horses for her own requirements, and has even some to spare for export (see Table 25). Nevertheless, the present condition of horse-breeding is by no means satisfactory. The continued import of breeders is alarming. Having once ascertained what types are particularly needed, one should work with those types and concentrate all one's efforts on them.

Among the measures that have been taken by the State during the last few years for the maintenance of horse-breeding, may be mentioned:

small *grants* for the introduction of properly kept *stud-books*, and for the *protection of native breeds of horses;*

grants to a *loan-fund* from which every year a sum of 100 000 kronor is to be made available for loans to horse-breeders for their purchases of thoroughbred brood-mares (cf. the Government Proclamation in the matter, dated July 4, 1913),

a law concerning the *compulsory inspection of stallions*, the aim of which is to prevent the employment of unsuitable and inferior sizes. This law, however, is of a facultative nature and cannot be applied in districts where the existing conditions make such a step necessary, before the proper Agricultural Society and County Council have applied to the Government to allow this step to be taken.

Reindeer.

A very special kind of animal husbandry is the reindeer-breeding pursued in the northernmost parts of Sweden. Originally begun and carried on exclusively by the Lapps, the Scandinavian reindeer-breeding, pursued in the northernmost parts of the country, is the westernmost and most highly developed offshoot of a branch of industry that forms the staple means of subsistence of a great number of different nomad peoples throughout the entire north of Asia and Europe. The considerable profit that this industry — originally an occupation confined to the Lapps — often yields under favourable circumstances has induced a number of Swedes and, more especially, Finns, too, to adopt it as a very remunerative means of supplementing their livelihood.

There are, broadly speaking, two main kinds of the reindeer industry in Sweden, viz. that of breeding the mountain reindeer and that of breeding the forest reindeer, which constitute two separate biological groups. Whereas the mountain reindeer takes to the mountains in summer, living in the forests only in winter, the forest reindeer is able to remain in the forest regions the whole year round.

The *mountain reindeer* are taken in the spring up to the mountains, where the animals find on the mountain prairies and snow-fields the pasture they require, and a sorely needed immunity from mosquitoes and gad-flies. Sometimes, the requisite supply of grass and snow not being forthcoming on the Swedish side, the reindeer have to cross over to Norway, occasionally penetrating right down to the coast. When autumn approaches, the animals move down again from the mountains to graze in the pine forests and especially on the extensive pine-barrens, where they find beneath the snow their winter food-supply, which consists almost entirely of a kind of lichen, called "reindeer moss". In certain cases (Västerbotten, and North Jämtland) the reindeer go right down to the Gulf of Bothnia; in others (South Jämtland, Härjedalen, and Dalarne) they merely move a few miles east of their summer grounds. The reindeer breeding industry in the mountains is carried on from Karesuando, in the extreme

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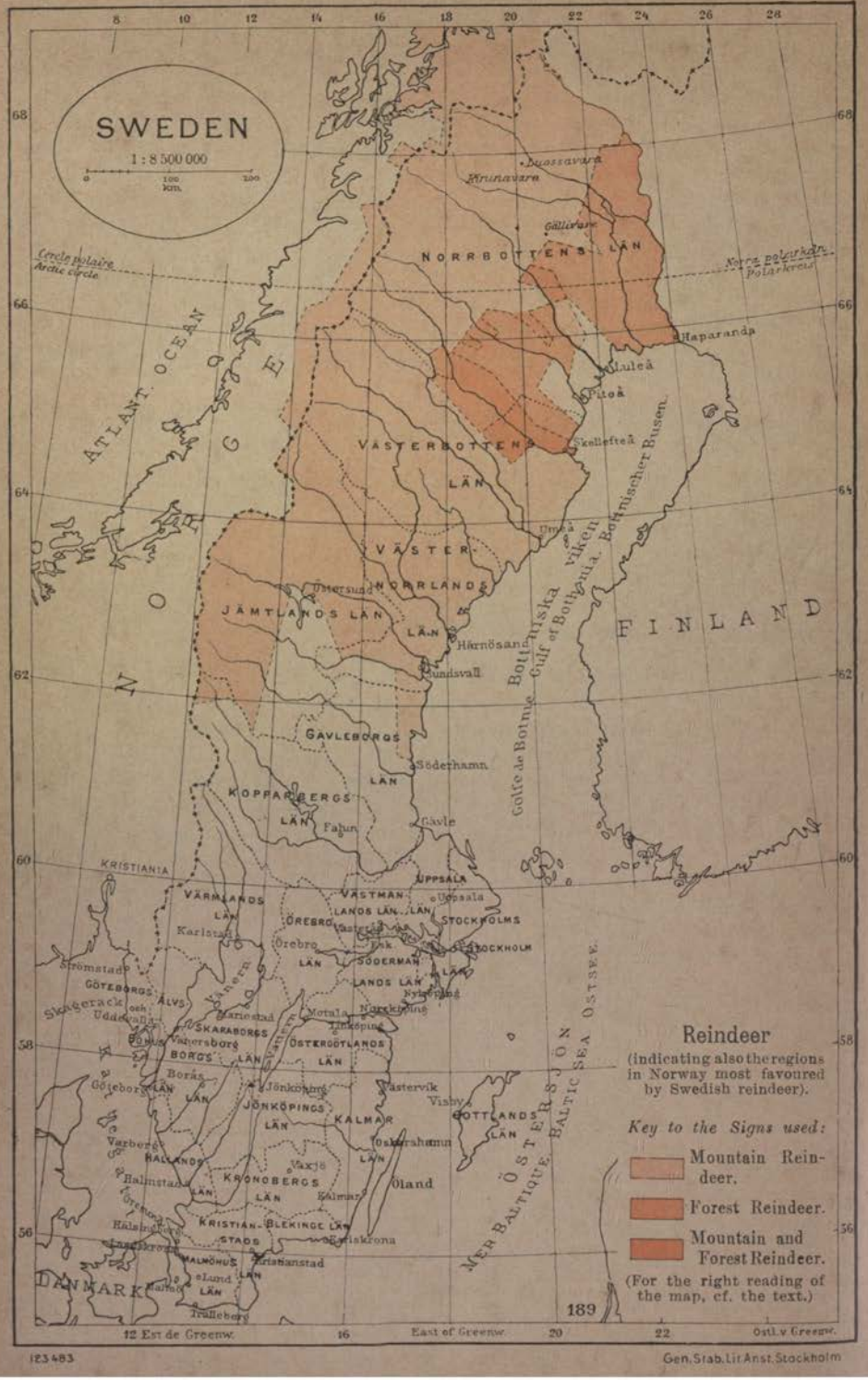

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north of Norrbotten, right down to the northern parts of Idre, in Dalarne.[1] It is actively pursued only by the Lapps, though a large number of mountain reindeer are owned by peasants.

Migrations also occur among the *forest reindeer*, but always within the pine forest, and in most cases to a very small extent. The forest reindeer finds his summer pasturage principally in large bogs, abounding in horsetails and marsh-trefoil, but in winter he feeds, like the mountain reindeer, on the pine-barrens. The migrations of the forest reindeer are thus confined to journeys to and fro between some suitable marshy region and a near-lying district with a good supply of reindeer moss. The breeding of the forest reindeer is carried on actively not only by the Lapps, but also by Swedes and Finns; as regards proprietorship, it is a remarkable fact that the greater part of the forest reindeer are owned by peasants. It is pursued, broadly speaking, in two districts, the chief of which consists mainly of the Finnish-speaking districts below the frontier of the Lapp territory, while the other lies between the lower reaches of the rivers, Luleälv and Vindelälven, within the Lappland frontier. The most northerly region for the breeding of the forest reindeer is the south part of the parish of Karesuando; the most southerly, Malå in Västerbotten.

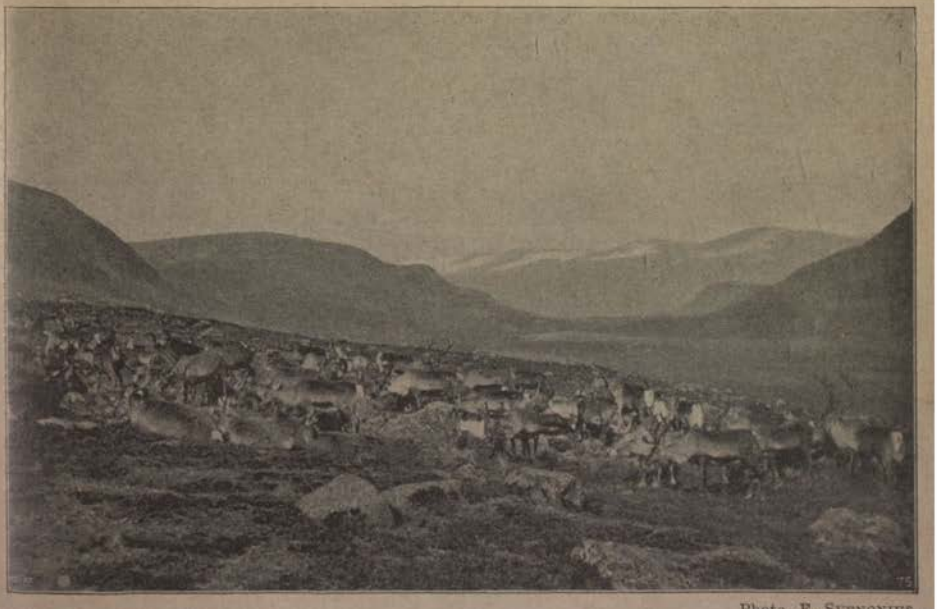

Photo. F. Svenonius.

Herd of Reindeer pasturing in summer among the mountains at Kvikkjokk.

The stock of reindeer belonging to Swedish subjects amounted in the years 1909—11 to 272 800[2] animals. Of these, 231 300 were mountain reindeer, and 41 500 forest reindeer. Of the mountain reindeer, 207 700 belonged to Lapps true, and 18 600 to peasants. Of the forest reindeer, only 18 800 were owned by Lapps, whereas 21 900 belonged to peasants.[3] The value of

[1] In winter, the reindeer sometimes move down to Central Hälsingland, although, as a rule, they go only as far as Medelpad (cf. map).

[2] All the figures adduced here are given to the nearest hundred and must be looked upon as quite approximate, minimum values. — [3] The peasants are mainly Swedes and Finns, but

the whole stock of Swedish reindeer may be put at about 4½ million kronor, at a rough valuation of 17 kronor per reindeer. The profit on them, however, may be estimated in normal years at the rate of about 25 %, and thus amounts to the respectable sum of more than 1 million kronor per annum. About half of this profit seems to be consumed direct in the shape of food, clothing, and other necessaries for the Lapps; the bulk of the other half, on the other hand, is employed in trade, chiefly in the form of entire reindeers, skins, and meat, to a certain extent also in sinews (for stitching boots and shoes) and horn (for making glue). Trade is also done in manufactured goods, such as Lapp furriery and, above all, Lapp shoes. There is also a fairly considerable export of reindeer products, either direct through Sweden to Germany, or via Norway to France, England, and even America. This export consists mainly of hides and entire animals. There are no reliable statistics available, which deal with this export. The distribution of the reindeer among the different läns is shown by the following table.

	Mountain Reindeer	Forest Reindeer
Number of Reindeer in Norrbotten Län, 1911	129 500	40 100
» » » » Västerbotten » 1909—10	74 500	1 400
» » » » Jämtland » »	25 700	—
» » » » Kopparberg » »	1 600	—

The opinion often expressed, that reindeer-breeding in Sweden is a decaying industry, which is bound to disappear with a more settled mode of existence, must unhesitatingly be set down as erroneous.[1] On the contrary, it would at present be more to the point to speak of an over-production of reindeer, seeing that their numbers overtax the capacity of the available pasture-grounds. As to the peasants, it is true that a good many disputes occur between them and the Lapps, but as the subject of these disputes is generally some damage done to the "grass marshes" *(slåttermyrar)*, and as the utilization of their scanty and almost worthless grass belongs to a most primitive method of agriculture, which will certainly disappear sooner or later, these quarrels will probably cease entirely. Under these circumstances, it is quite unwarrantable to look upon reindeer-breeding as doomed to extinction. Precisely in virtue of its nomad character, it has a definite mission to fulfil: for it is only by a nomad mode of existence that the supply of grass and reindeer moss in the mountains and pine-barrens can be, economically speaking, utilized to the full. There is therefore every reason for encouraging Swedish reindeer-breeding, and for regarding it as a branch of Swedish industry destined to survive, and as one bidding fair for the future.

Rabbits.

Towards the close of the Middle Ages this ancient branch of industry underwent a great development in Europe, thanks to the efforts of the monks. In Sweden, however, the interest in rabbit-breeding has always been very slight, notwithstanding that private persons and societies have laboured to improve it. There is no doubt whatever that rabbit-breeding can also be rendered profitable in Sweden; but rabbit-breeding, like that of all other domestic animals, requires time and thought, and thus rabbit-keeping is not as well suited for Swedish

a few Lapps have also been included among them. In consequence of certain regulations, practically all the reindeer owned by peasants are from the Län of Norrbotten. The remaining 5 800 reindeer were "unknown" or "unmarked".

[1] It is not possible to support this statement by statistics, early data as to the numbers of reindeer being unreliable.

peasants as is commonly believed. The great majority of Swedish rabbit-breeders keep unimproved breeds of county rabbits. There also occur in Sweden a number of foreign breeds, such as the large French rabbit, the little silver rabbit, and the white Danish country rabbit. The latter is considered to be suitable for crossing with the Swedish country rabbit, to improve the breed.

Poultry-Breeding.

Cocks and hens, ducks, and geese were found in Sweden as long ago as the Iron Age. On the other hand, the turkey was not introduced before the end of the 16th century. The hen-roost and the goose-pen were ordinary parts of the equipment of an ancient northern cottage, and in many parts of the country they were retained far into the last century; nowadays, poultry has, almost everywhere, been relegated to the barn-yard, or to special poultry-houses.

The total number of poultry in Sweden is estimated to be at least 4 250 000. Poultry-breeding, as a whole, is not in a thriving condition in Sweden, except in the southernmost provinces, from which a large export of eggs and poultry takes place. Skåne and Öland do a thriving trade in geese: in the autumn they send a considerable number to other parts of Sweden and to Denmark.

A number of different breeds of poultry have been introduced into Sweden; the Leghorn, Plymouth Rock, Wyandotte, and Orpington fowls, the Rouen, "Svenska Blå", Aylesbury, and Peking ducks, the Skåne, Toulouse, Emden, and Pomeranian geese, and the Bronze turkey have the best reputation and are the breeds most widely spread.

Interest in poultry-breeding seems to be increasing. In 1898 was formed "Sveriges Allmänna Fjäderfäavelsförening" (Society of Swedish Poultry Breeders), which was joined by a large number of members from different parts of the country: in 1912 the number of members was 6 701, belonging to 23 provincial associations. The Society receives a subsidy from the State, to which must be reckoned the contributions made by the Agricultural Societies to the provincial associations. The Society works in a variety of ways for the promotion of poultry-breeding in Sweden. It employs salaried experts, arranges exhibitions, inspects and subsidizes breeding-establishments, attends to the control of egg-laying, distributes breeding-eggs and breeding-fowls, etc. Furthermore, on the initiative of the Society, many small producers, who carry on poultry-breeding with great advantage, have been induced to form "Egg-Selling Associations", whereby better conditions of trade have been secured. The export of eggs from Sweden is mainly due to the existence of these associations.

In 1910 there were in Malmöhus Län no less than 60 of these associations, which collected eggs from 160 places.

Eggs are *exported* from the southern provinces to England, direct or via Denmark. Table 25 shows that the import of eggs has remained almost at a standstill during recent years; the export, however, has increased to such an extent that in 1913 it exceeded the import.

Bee-Keeping.

The bee has been domesticated in Sweden since time immemorial.

In most places in Sweden the conditions are extremely favourable for making bee-keeping pay. Bee Associations, by disseminating knowledge as to the management of bees, and the Agricultural Societies, by granting subsidies, have endeavoured to obtain for bee-keeping its proper place among the most impor-

tant of minor industries, and during the last few years it has really made considerable progress. However, there are still many places where it has to fight its way, and large profits are lost owing to bad methods: a large part of the nectar secreted from the flowers, instead of being collected and made productive, is allowed to go to waste. When we remember that a community of bees as a rule yields a yearly income which on an average equals its initial cost, and that bee-keeping requires comparatively little time, it becomes clear that bees are, relatively speaking, the most profitable of our domestic animals. For people of small means who wish to eke out their incomes and procure a certain amount of comfort and well-being bee-keeping is a factor to be reckoned with. Bees bring in many thousands of kronor in the form of honey and wax; but the *indirect* advantage that accrues from them in the fertilisation of plants may be said to be far greater. Thus these small workers ought to be welcomed more heartily than is at present the case in Sweden, where there is pasture enough for a far larger number of bee communities. In 1911 the bee-swarms numbered at least 120 000, while the annual production of honey may be computed at about 600 000 kg; and of wax, at 10 800 kg.

For the import and export of honey and wax, see Table 25.

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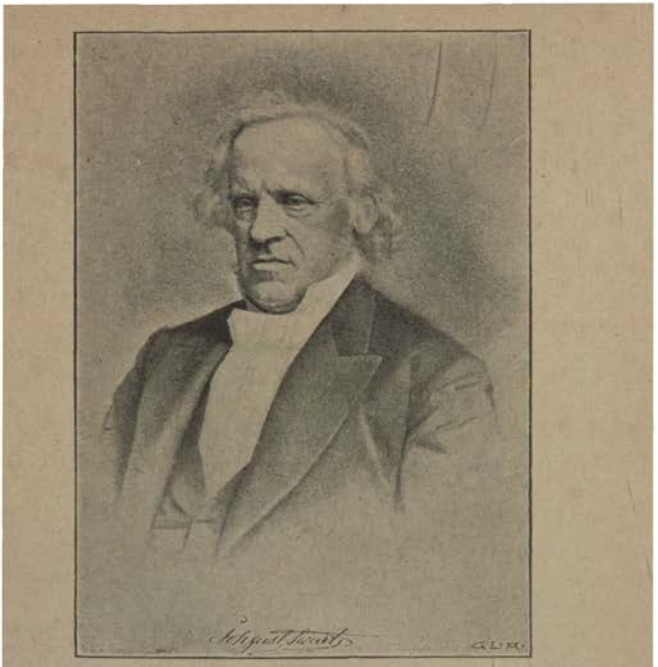
3. DAIRIES AND DAIRY-INDUSTRY.

We give below a short history of the development of the dairy-industry in Sweden, together with an account of the present condition of the industry, and, in this connection, a summary of the measures taken during the last few years for the promotion of this important branch. In connection with this subject, too, a few words will be devoted to dairy-machines and implements, in regard to the invention and manufacture of which, Sweden can, without contradiction, be considered as a pioneer country.

The development of the Dairy-Industry.

The dairy-industry has ancient traditions in the agricultural industry of Sweden, for it can be traced back nearly 700 years; almost to the close of the 16th century, cattle breeding and the manufacture of butter and cheese were important and lucrative national industries. Then succeeded, however, long periods of stagnation and decline, the small quantity of milk produced, over and above that required for daily needs, being worked up at home under the superintendence of the farmer's wife or some woman servant. It was not before the middle of last century that a change for the better set in in this respect, but at first it was only on a few large estates that systematic dairying was commenced, in "*Manor-farm dairies*" as they were called. In 1840 *R. Tornérhjelm* established a dairy on his estate, Gedesholmen, in Skåne, on the so-called Holstein, or "open-pan system", and engaged dairy-hands from Holstein to manage it. The method, however, never gained any great support, and the same may be said of that invented by *P. U. Gussander* and called after him. In certain respects, however, the last-mentioned method has contributed in no little degree to the development of Swedish dairying, more

especially by its adoption for dairy purposes of vessels and implements made of tinned sheet-iron. Both the above methods of creaming were hampered by their demand for space and many vessels, and great difficulty was experienced, too, in keeping the milk sweet during the process of creaming.

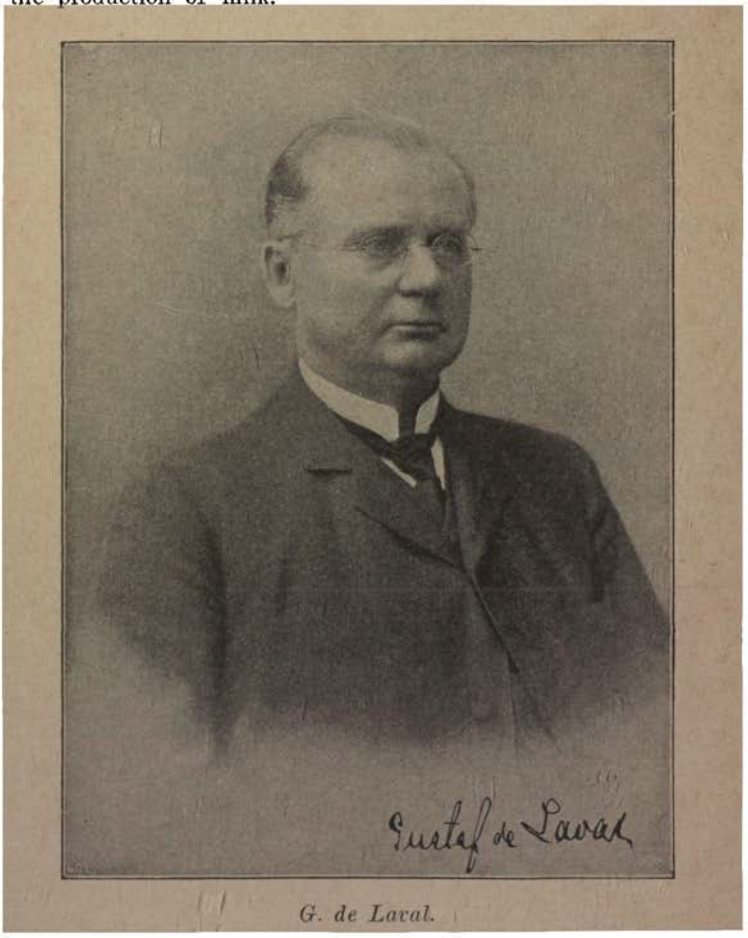


J. G. Swartz.

During the sixties, however, more energetic efforts began to be made to spread among the farmers a knowledge of rational methods of dairying. The Academy of Agriculture and the Agricultural Societies were at the head of the movement, and a rapid development was soon noticeable. One thing that contributed to this in a very great degree was the introduction of the **ice-method,** invented by *J. G. Swartz* about the middle of the decade in question, and according to which the creaming took place in high, cylindrical or oval vessels, immersed in ice-water. This method rendered it possible to carry on the dairy-industry on a large scale, and became very extensively employed, as things were at that period. Dairying now began to be pursued on a more extensive scale; a number of manor-farm dairies extended their operations and bought milk from the country round about, and, in addition to these, there arose so-called *"Dairy Companies"* (Sw. uppköpsmejerier), which were not carried on in connection with farming, but merely handled milk that was purchased. Most of the companies in question had as their chief aim the manufacture of butter for export. The export of butter increased rapidly, and by 1870 had risen to 2 324 000 kilograms, the figures showing a surplus of 309 400 kilograms over the imports.

For the purpose of extending their field of operations, many dairies began to purchase cream and also to establish branch-departments, where the milk was received and the creaming carried out, after which the cream was sent to the principal dairy to be made into butter; there was thus created a system with

a *central churning-dairy* and a ring of *creaming-stations*, each of the latter with a number of milk-suppliers. During the decade 1870—80 this system was much employed, in central Sweden especially. Among those that were most active in the establishment and promotion of these dairies, *H. A. Lidholm* of Nådhammar is specially deserving of mention.. As a rule, the butter produced by these churning-dairies was hardly of first-rate quality, but at that period people had not the same pretentions in that respect that they now have. The dairies in question have been of great importance for dairying, as they gathered round them large numbers of milk-suppliers, whom they induced to make efforts to increase the production of milk.



G. de Laval.

With the eighties, dairy-farming began a new phase of existence, in consequence of the introduction of machine-creaming when *G. de Laval* placed his **separator** on the market. This invention enabled the dairies to treat considerably larger quantities of milk, and they soon began to purchase supplies from much wider areas than before. The delivery of cream came to an end, the unskimmed milk being sent, instead, direct to the dairies. The churning-dairies had played their part, for the present at least, and were either closed or converted into separator-dairies receiving direct supplies of milk. The number of dairies increased rapidly, and Dairy Companies (Sw. uppköpsmejerier,

bolagsmejerier) were established in every part of the country. The production of butter increased very considerably year by year, and Sweden took a place in the list of the principal butter-exporting countries. But the competition between the dairies became too great; in their endeavour to obtain as much milk as possible, they neglected to maintain their demand for high quality, and winked at rather serious deficiencies in this respect — the purity and freshness of the milk often being seriously at fault — and this, of course, acted injuriously on the quality of the butter. Another essential error was that quite a large number of inexperienced persons — who, in addition, were in want of the necessary capital — began to establish dairies. The Dairy Compa-

Imports and Exports of Butter.

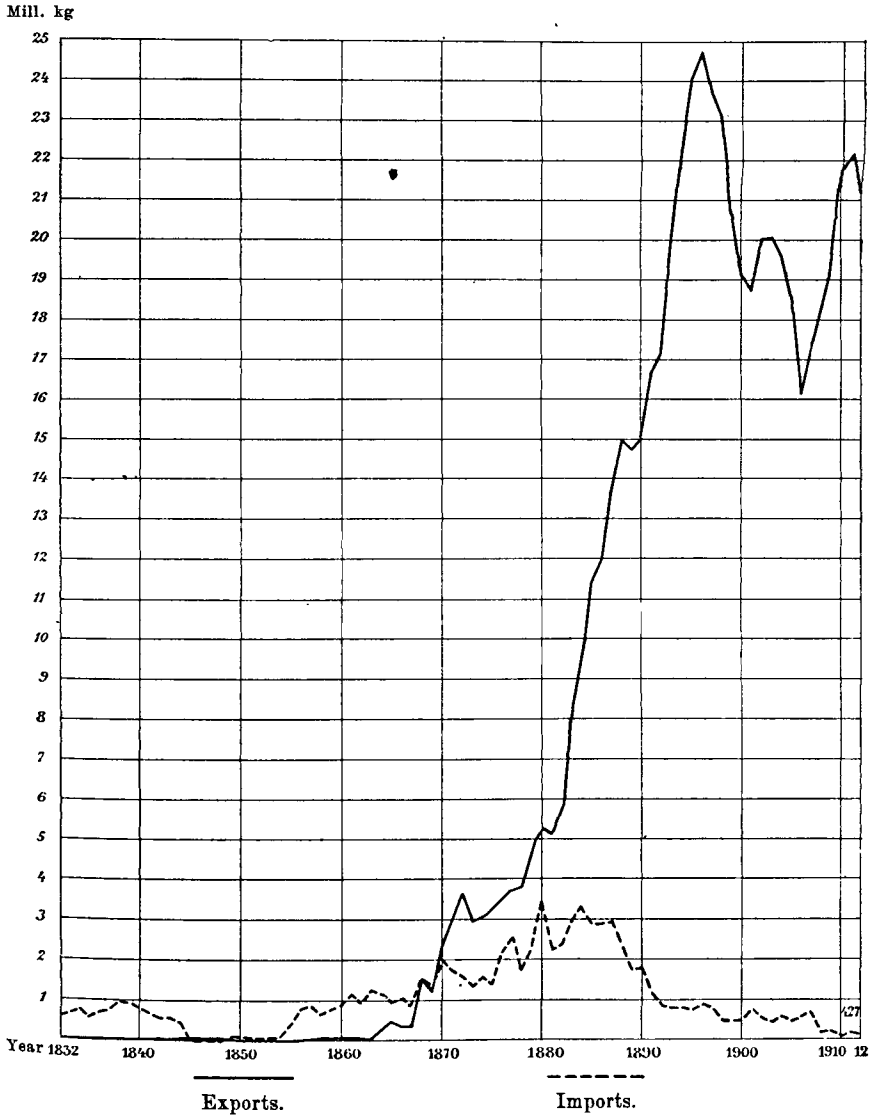


TABLE 26. *Imports and Exports of Butter and Cheese.*

Annually	Butter, kg			Cheese, kg		
	Exports	Imports	Exp. — Imp.	Imports	Exports	Exp. — Imp.
1801—1810 . .	3 570	38 420	— 34 850	13 720	328 770	— 315 050
1811—1820 . .	16 070	284 680	— 268 610	7 290	261 370	— 254 080
1821—1830 . .	14 290	844 910	— 830 620	500	284 700	— 284 200
1831—1840 . .	7 520	726 460	— 718 940	790	157 370	— 156 580
1841—1850 . .	11 130	230 500	— 219 370	840	80 460	— 79 620
1851—1860 . .	19 110	432 580	— 413 470	7 800	372 290	— 364 490
1861—1870 . .	661 060	1 209 760	— 548 700	59 910	419 770	— 359 860
1871—1880 . .	3 674 910	1 960 390	+ 1 714 520	147 100	615 360	— 468 260
1881—1890 . .	11 057 880	2 521 350	+ 8 536 530	158 330	395 080	— 236 750
1891—1900 . .	21 142 549	730 258	+ 20 412 291	102 300	258 320	— 156 020
1901—1910 . .	18 919 889	434 869	+ 18 485 020	12 950	411 135	— 398 185
1911	22 175 688	155 597	+ 22 020 091	2 956	337 215	— 334 259
1912	21 236 722	123 885	+ 21 112 837	5 430	580 211	— 574 781
1913	19 654 318	195 986	+ 19 458 332	2 742	550 548	— 547 806

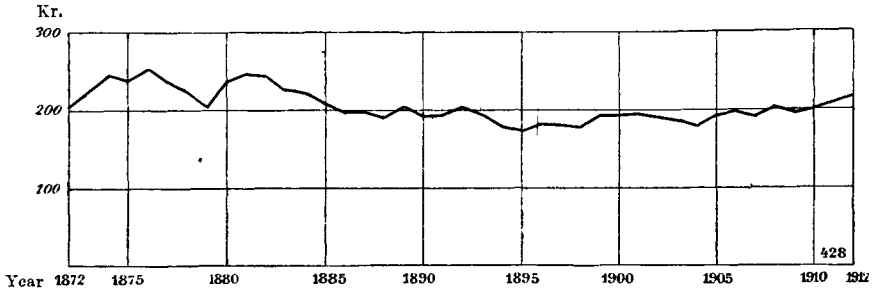
Note. Regarding value of imports and exports, cf. Table 8, p. 30.

nies also found it a very difficult matter to dispose of the skim-milk in a satisfactory way.

At the beginning of the nineties, these evils were to an essential degree cured by the employment of a new system for dairying called the *Co-operative system* (Sw. andelsprincipen), a feature which may claim to be the most prominent one in the history of the development of dairy-farming in Sweden, during the last decade of the century. Dairies of this type had been in existence in Denmark ever since the middle of the eighties, and had gained great support. It is true, that the first Swedish Co-operative dairy had been established at Vilan, in Skåne, in 1880, but it was not before the beginning of the nineties that the class of dairies in question gained a firm footing in the country. In 1890, of the then existing 1 562 dairies, only 73 were co-operative establishments, but five years later, out of 1 793 dairies, 302 were on the co-operative principle, a total which has since gradually increased. The strength of the co-operative system lies, above all, in the fact, that the milk-suppliers have common interests and enjoy a sense of joint proprietorship; they themselves receive the profits that may be obtained from the milk produced on their farms. The consequence is that they see it is to their interest to deliver milk of good quality. It is easier, too, for the dairies in question to obtain the necessary capital, so that it becomes easier for them to keep pace with the demands of the times in the arrangement and equipment of their dairies. In another respect, too, these dairies are in a better position than their rivals, the Dairy Companies, viz., as regards the employment of the skim-milk, this being taken back by the milk-producers and utilized in the most suitable way on the farms.

In the above remarks only butter-making has been mentioned. The second principal branch of dairying, the **manufacture of cheese,** has not, in Sweden reached a position at all comparable with that held by butter-making. It is true that, at an earlier date, cheese-manufacture was carried on on a relatively large scale, but in the same degree that the main interest of the dairies gradually aimed at increasing the export of butter, nearly all the milk supplied to the establishments mentioned was employed for making butter, only a small percentage being devoted to the manufacture of cheese, the home-supply of which has not, as a rule, been quite sufficient to satisfy the Swedish markets, so that

Prices of best export Butter. Per quintal.



there has nearly always existed an excess of imports of cheese. Every now and then efforts have been made to create an export to England, now of one kind of cheese, and now of another, but the attempts were soon relinquished. The competition with cheap and excellent products from the U. S. A., Canada, Holland, and other countries, which fill the English market, was too severe, and, in addition, the export prices have always been lower than the figures quoted in the home-market, so that it was impossible to obtain higher prices for the milk by converting it into cheese than by making butter of it.

In Table 26 a survey of Sweden's exports and imports of butter and cheese from 1801—1913 is given as an illustration of the development of the dairying industry of the country during the period in question.

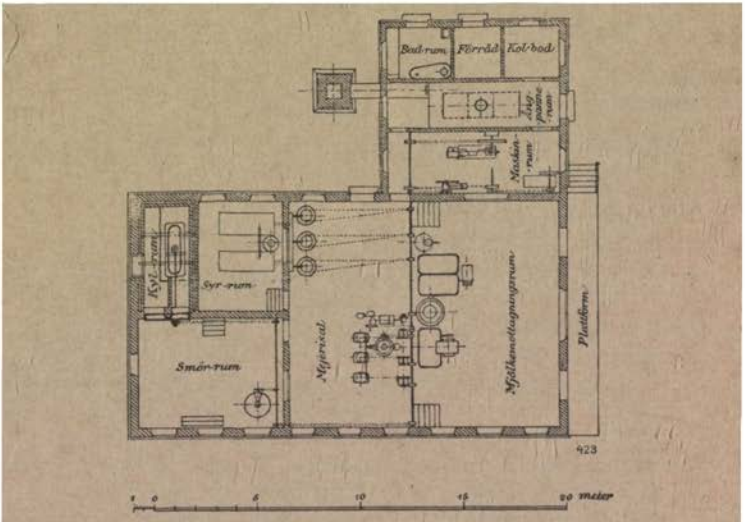
The effect of the ice-method during the seventies and of the introduction of the separator system after 1880 is very clearly shown by the great excess of the exports of butter over the imports which begins then. As regards cheese, the average figures show a steady surplus of imports, but as a matter of fact, some few years (1871, 1887, 1888 and 1891) give export-figures which are in excess, although but slightly, of those for the imports.

The present position of the Dairy-Industry in Sweden.

The production of milk. The raw material employed in Swedish dairying is almost exclusively cow's-milk. It is true that, in certain parts of the north of Sweden, some little goat's milk is used in the manufacture of goat's-milk cheese and whey-cheese, but the amount is comparatively little and plays a very unimportant rôle in the milk-economy of the country. According to the statistical reports for 1911, the number of cows possessed by Sweden in the year named was 1 837 035; all of these, however, cannot be reckoned as milk-producing, as under this heading are included all heifers not less than 2 years old. It is impossible to give any reliable figures for the average annual production of milk per cow. The averages given in the reports issued by the Swedish Cow-Testing Associations vary with the character of the animals and especially with the breeds to which they belong, and also with the quality of the feeding of the cows. They amount in the southernmost läns of Sweden to more than 3 000 kilograms of milk per year, in Central Sweden to about 2 700 kilograms, and in the north of the country, to about 2 000 kilograms. According to the reports for 1910—11, the average milking for the Malmöhus Län Dairy Control Associations was 3 501 kilograms; for those of Kristianstad Län 3 176 kilograms; for those of Skaraborg Län 2 679 kilograms; of Östergötland Län 2 631 kilograms; of Stockholm Län 2 732 kilograms and for those of Jämtland Län 2 093 kilograms. These figures, however, cannot

be considered as being any expression of the average milking for all the cows in these various parts of the country, as of course, the Control Associations embrace the better class animals, the feeding of which, too, has been carried out in accordance with the most rational methods. In round numbers, the milk production of Sweden is estimated at somewhat more than 3 milliards of kilograms.

The uses to which the milk is put. The milk is used for human food, for rearing and fattening calves, for rearing pigs, and for manufacturing butter and cheese; a small quantity is exported, chiefly in the form of cream, which is sent to Germany. Of the by-products obtained in the manufacture of butter and cheese — skimmed milk and whey — a small quantity is used for the making of serine (dried milk or milk-meal), caseine, and lactine; the greater part goes to calves and pigs; a part of the skimmed milk is made use of as food for human beings. Only approximate estimations can be given of the amounts of milk employed for each of the above purposes. The amount of milk taken for direct consumption and culinary purposes is estimated, from some general observations, as amounting to 0·5 kilogram daily, per head of the population, which, for the whole country, gives a consumption of a little more than 1 milliard kilograms per annum. Only a small amount of milk — about 100 million kilograms per year — is used for calves and pigs. The amount of milk employed in the manufacture of butter and cheese would, thus, amount to 2 milliards kilograms yearly.



Plan of Co-operative Dairy.

The Dairies. In 1910 there were in Sweden 1 416 dairies, 550 of which were co-operative dairies, 475 company dairies, 278 manor-farm-, and 113 manor-farm milk-purchase dairies. The co-operative system has gained its greatest number of adherents in the south and north of the country, while in Central Sweden the dairy companies and manor-farm dairies are predominant. In the southernmost läns — the two Skåne läns, and those of Halland, Blekinge, and Southern Kalmar, there were, at the date given, no less than 205 co-operative dairies, the dairy companies' establishments numbering only 47, and the manor-farm-, and the manor-farm milk-purchase dairies together coming to no more than 35. In the Norrland läns — those of Norrbotten, Västerbot-

ten, Västernorrland, and Jämtland — there were 104 co-operative dairies, and only 14 dairy companies'- and 12 manor-farm- and manor-farm milk-purchase dairies. If, on the other hand, we glance at Central Sweden, we find in a single län — that of Skaraborg — 209 dairy companies'-, and 59 manor-farm- and manor-farm milk-purchase dairies, as against only 29 co-operative dairies, and the three läns that come next to Skaraborg in point of milk-production — those of Östergötland, Södermanland, and Stockholm — have 78 dairy companies'- and 96 manor-farm- and manor-farm milk-purchase dairies, and only 43 co-operative dairies. The size of the dairies varies considerably. In the foremost rank come the dairies in Malmöhus Län, with a daily average of 8 000 kilograms of milk, the figures varying between 3 400 kilograms for the smallest co-operative dairies, to 22 000 kilograms for the largest. The least amount of milk handled by the dairies is found in Västerbotten Län, where the daily average is only 400 kilograms. The value of the dairy-buildings, etc., shows the same variations; in Malmöhus Län the average value of the co-operative dairies is 37 565 kr., and in Västerbotten only 3 920 kr. The total quantity of milk weighed on receipt at the dairies in 1910 was 1 149 219 973 kilograms, of which 136 969 685 kilograms were sold as unskimmed milk. Somewhat more than 1 milliard kilograms of milk were, therefore, used in the dairies for the manufacture of butter and cheese. Butter alone was made at 845 dairies; fat-cheese alone was made at 327 dairies, and both butter and cheese were made at 208 establishments.

The manufacture of butter. Butter still occupies the first place among dairyproducts, and its manufacture constantly increases, amounting in 1900 to 26 114 018 kilograms, in 1905 to 27 999 409 kilograms, and in 1910 to 32 938 444 kilograms. Butter-making is carried on most extensively in Skåne and Halland, the production of butter at the dairies in these two läns amounting in 1910 to about one-half of the quantity made at all the dairies of the country. Among other läns where the manufacture of butter is carried on very extensively may be mentioned those of Östergötland, Skaraborg, Södermanland, and Västmanland.

The butter is produced from cream obtained by skimming the milk, this process, nowadays, taking place almost exclusively by means of the separating-system; in one or two places, where skimmed milk can be sold at a high price for direct consumption, the ice-method is still employed. The majority of the separators in use are Alpha-separators, which can be had in three different sizes, skimming 1 000, 2 000, and 3 000 kilograms of milk per hour respectively, skimming as close as to 0·07 % of fat in the skimmed milk. As a rule the milk is pasteurized, either the pure milk (helmjölken) before skimming, or else the cream and the skimmed milk separately. Pasteurizing is not, as in Denmark, obligatory by law, but efforts are at present being made to have such a law passed in Sweden, too. In connection with the process of pasteurizing, there is employed in many places, and especially and very generally in Malmöhus Län, the regenerative system, whereby a part of the warmth of the pasteurized milk is utilized for the purpose of preparatorily heating the cold milk. Nearly all the butter produced here is the so-called sour-cream butter (Sw. syrat smör), which is obtained by submitting all the cream intended for the making of butter to a souring-process, produced by the bacteria of lactic acid. For this purpose there is very generally employed a pure culture of lactic acid bacteria, the activity of which is preserved by the culture being placed every day in a fresh preparation of thoroughly pasteurized skimmed milk; in some places again, butter-milk is used as the souring preparation or starter. The souring of the cream takes place, as a rule, at a low temperature (11—15° C.) and the cream which is thus set on the one day for souring ought

to be soured by the next day, at a suitable time for the churning. For the churning and the working up of the butter there are employed the older, so-called Holstein churns and mechanial butter-workers, and also a newer type of machine — a combined churn and butter-worker, this latter, apparently, seeming to be rapidly ousting the oldfashioned apparatus, especially at the larger dairies, where it greatly facilitates the working of the butter. For the salting of the butter, the very finest-grained salt is used nowadays, in the place of the relatively coarse-grained salt always recommended before. All the butter intended for export is packed in barrels, each containing preferably an English hundredweight (centner).

Several inventors have endeavoured to construct machines to skim and churn at the same time. The only one of these machines that has come into any use is the radiator, invented by *E. G. N. Salenius*. Its employment, however, has not become very general, and, during the last few years, no new radiator-dairies have been established. The radiator-dairies produce sweet-cream butter, the greater part of which is sold within Sweden.

The gross price which milk — as a result of its employment for butter manufacture — can fetch, depends, of course, on the percentage of fat in the milk, and also on the price that can be had for the butter, skimmed milk, and butter-milk, and can easily be calculated if these factors are known. But from the gross price there have to be deducted the costs of manufacture, which vary greatly with the different dairies, this depending upon local conditions and also upon the size of the dairies. The expenses in question are lowest at the largest dairies. According to the co-operative dairy-farming working statistics for 1910, the expenses, apart from those for carriage, in the Läns of Malmöhus and Kristianstad amounted respectively to no more than 4·97 and 5·05 kr. per 1 000 kilograms milk, while in Norrbotten Län, where the daily quantity of milk per dairy amounted to only 902 kilograms, the expenses in question rose to 14·29 kr. It is clear that such an increase in working expenses must have a most injurious effect on the economy of the dairy-farming, and in thinly-populated parts of the country, where it is impossible to collect any large quantity of milk without the costs for carriage becoming altogether too heavy, it has, consequently, been difficult to start a paying butter-making business. One method of solving the problem has been attempted, however, during the last few years. At the close of the nineties there was established at Nybro, in Småland, a dairy company based on the delivery to the dairy of cream; i. e., a so-called "cream-dairy". At Glimåkra, in the northern part of Kristanstad Län, a co-operative dairy was established in 1904, on the same system, which proved a financial success and has had many imitators in the forest districts. These dairies were supplied with cream skimmed from the milk at the farms of the various producers by means of hand-separators. This system greatly facilitates transport, and other working expenses of the dairies also become less. The type of dairy in question has one disadvantage, however, for the cream skimmed at the farms is not always so well handled as could be wished, the result being that these dairies find it difficult to produce butter of uniformly good quality. It is possible that this disadvantage could be avoided by establishing small skimming-stations around a central churning-dairy, but such a system is imaginable only on the supposition that the skimming-stations can be erected at sufficiently low cost. The plan appears to have been made possible by the Baltic-turbine dairying machine, which was put on the market by the Baltic Co., Ltd. in 1911, and which is a combination of boiler, a turbine-driven separator, regenerative-pasteurizing apparatus, and the necessary pumps, all driven by the separator-turbine. The whole machine occupies a floor-space of 1·1 × 1·4 square meters, and treats from 750 to 800

kilograms of milk per hour. The dairying machine can also act as an independent butter-dairy, as it is possible to connect it with a small churning-apparatus.

A not unimportant quantity of butter is made at the farms, both for home-consumption and also for sale; it is known as farm-butter (Sw. bondsmör). In tracts which are thinly populated and where "cream-dairies" have not as yet been established, hand-separators and hand-churns are still pretty extensively used. This is the case in a great part of Norrland, in Kopparberg Län, and in Göteborg och Bohus Län. In the latter län, dairy-farming on a large scale has almost died out, partly as a result of this home-manufacture, and also in consequence of large amounts of milk being sent for direct consumption to Gothenburg, fishing-hamlets, stone-quarries, and sea-side places. In 1890, there were 32 dairies there, with a yearly milk-supply of 9 600 000 kilograms; in 1910, the number of dairies was only 5, and the amount of the milk treated but 2 200 000 kilograms.

The manufacture of cheese has slowly but surely increased during the last two decades; the increase, however, is for the fatter kinds of cheeses only; the production of skim-milk cheese, on the other hand, has diminished, as may be seen by the following figures.

	Production (in kg) of			
Year	fat cheese	half-fat cheese	quarter-fat cheese	skim-milk cheese
1890	1 745 110	587 570	—	4 261 900
1895	2 123 287	742 487	—	4 048 701
1900	3 265 734	1 463 370	182 809	2 523 542
1905	4 440 707	2 006 258	203 486	1 978 747
1910	5 667 620	2 360 953	494 007	1 613 479

About one-half of the fat cheese is made in Skaraborg Län; next come the Läns of Östergötland and Jämtland. In the last-named län, cheese is the principal product at most of the dairies, and the same can be said of Västerbotten Län. During the last few years, Malmöhus Län, which produces a great amount of butter, has commenced to make the fat cheeses, and now ranks fourth as regards its production. Half-fat- and quarter-fat cheeses are produced mostly in Central Sweden; Södermanland, Skaraborg, Örebro, Östergötland, and Stockholm Läns, in the order given, being the parts where these kinds of cheese are most produced. The manufacture of skim-milk cheese is carried on principally in Södermanland and Skaraborg Läns, and also in the Läns of Örebro, Västmanland, and Kopparberg. The fat cheeses produced are mostly Swedish manor-farm cheese, Norrland fat cheese, and Västgöta cheese; Cheddar- and Gouda cheese are made at a small number of dairies.

The method of manufacture is that ordinarily employed for making hard rennet-cheese (Sw. löpeostar), with variations in details, according to the kind of cheese it is desired to obtain, the quality of the milk, and, very often, in agreement with methods long employed at some certain place. As the ripening of the cheese is a process brought about by bacteria, the successful carrying out of the cheese-manufacture depends a great deal, of course, on the bacterial flora of the milk. Experience has shown that a relatively large percentage of lactic bacteria are necessary for a proper course of ripening, and it has long been a custom, in the manufacture of certain kinds of cheese, to enrich the milk, after the rennet is put in, with lactic acid bacteria, by the addition of sour whey. Nowadays, here and there in Sweden, there is added a pure culture of lactic acid bacteria, even in the manufacture of such kinds of cheese for which, formerly, this process was never used. The result is that a much more uni-

form quality is obtained, and that there is less of the risk always attached to the manufacture of cheese. In many dairies the method has now been adopted of giving the cheese, before its removal to the curing-room, a coating of melted parafine, which diminishes the loss during curing and storing and also makes the work of keeping the cheese clean and free from mould easier. This diminution of loss being one of great economical importance, the method in question will probably come more extensively into use.

The utilization of the by-products. The by-products obtained in the manufacture of butter and cheese — skimmed milk, buttermilk, and whey — are utilized in many different ways. *Skimmed milk* is employed as food for human beings, for the rearing of calves, for manufacturing cheese, and in margarine and margarine-cheese factories, and also for making milk-preparations; the greater part is employed, however, for the rearing and fattening of pigs. The most important milk-preparations made from skimmed milk are serine and caseine. Serine is obtained by drying the milk at a low temperature in vacuum in the exsiccator invented by *M. Ekenberg*. The product obtained in this way is ground to coarse grains, then dried, and finally ground into fine meal. Serine factories exist at Hälsingborg and Ystad. Caseine is obtained by souring the skimmed milk, after which the curdled caseine is separated from the whey, washed in water, and pressed. The ready-pressed caseine is bought from the dairies by caseine-factories, which dry it and grind it to fine meal. In 1910, there were 8 such caseine-factories in Sweden, viz., at Svalöv, Eslöv, Flen, Västerås, Hallsberg, Mjölby, Skara, and Lidköping. *Butter-milk* is mostly employed for fattening pigs. *Whey* is also mostly used for the same purpose, but a not unimportant part is employed, in Jämtland especially, in the manufacture of whey-cheese (Sw. mesost). Whey-cheese is obtained by boiling the whey down to an almost solid, somewhat doughy mass, which is moulded and, after a few days' drying, is ready for use. Pure milk-sugar can also be produced from whey; an impure product, raw milk-sugar, is obtained by boiling down the whey to crystallization, and afterwards refining it. There are two small milk-sugar factories at Hörby, in Skåne, and at Björketorp, in Västergötland. Attempts have been made at many places to prepare a relatively cheap product, rich in nitrogen, intended to be employed in baking, cooking, etc., for the purpose of adding easily digestible albumen to the food. Such a product, "proton", consisting of soda-caseine, was made for a time at Hamra, near Stockholm, but the manufacture has been abandoned on account of the slight demand.

The measurement, payment for, and judging of the milk. In most dairies the milk is weighed and is expressed in weight (kilograms), but capacity-measure (the liter) is the one most employed in retailing milk to home consumers. At a number of dairies the milk is still paid for only by measure, but nowadays regard is also paid to the percentage of fatty matter contained by the milk. During the last few years, too, growing importance has been paid to the quality of the milk, and special milk-testers have been appointed at several places for the purpose of having the milk judged impartially. Several dairies have united to form Milk Testing Associations, with testers common to the various dairies. The first Milk Testing Association was formed in Södermanland in 1907, since which date similar associations have been established in various parts of the country. The aim of these associations is stated, in the regulations for that in Södermanland, as being to carry out regular and exact examinations of the milk supplied to the dairies, in order that the quality of the milk may be thereby improved, and also to determine regularly the percentage of fatty matter contained by the milk, so that not only the dairies, but also the suppliers may be able to obtain fully reliable and impartial information with regard to these matters. The testing of the quality of the milk is made by means of smelling

and tasting, by determining the amount of foreign matter contained, and also by the so-called reduction-test, which gives an approximate estimate of the quantity of micro-organisms contained by the sample of milk. The results of this examination can occasion remarks, warnings, reductions in price, or a refusal to accept the milk supplied, all in accordance with special regulations. The tests for the fat-percentage, which form the basis of the calculation of the price of the milk, is usually carried out by means of Lindström's butyrometer, which has proved very suitable for testing large quantities of milk.

Trade mark for choicest Swedish butter, placed on the barrels and paper (The rune mark).

Trade in dairy produce. *Milk and cream.* In all the larger centres of population in Sweden, the communal authorities have had regulations issued regarding the sale of milk, with the demands of milk-hygiene more or less strictly applied, and often with a minimum limit for the percentage of fat. Some amount of milk and cream is exported to Denmark and Germany; the export of cream to Germany, especially, ought to be profitable as long as there is no duty on it; butter, however, has to pay duty. *Butter.* The home butter-market is protected by a duty of 20 öre per kilogram. The principal aim of this duty is to prevent in some measure the import of cheap Siberian butter, and in this way it serves to protect the home production of "farm-butter" and of margarine. At present the greater part of the butter made in the dairies is exported. The amount of this export, and the share taken by various countries since the beginning of the present century can be seen by Table 27.

The export is principally via Gothenburg, Malmö, and Halmstad. The butter exported via Malmö is sent for the most part by the Skåne Butter Export As-

TABLE 27. *Exports of Butter, by Destination.*

Year	Total exports, by quintals, to					Percentage				
	England	Denmark	Germany	Other countries	Total	England	Denmark	Germany	Other countries	Total
1900 .	105 737	85 747	117	27	**191 628**	55·18	44·75	0·06	0·01	**100**
1902 .	98 876	101 014	146	513	**200 549**	49·30	50·37	0·07	0·26	**100**
1904 .	101 898	93 003	207	593	**195 701**	52·07	47·52	0·11	0·30	**100**
1906 .	107 340	53 899	371	380	**161 990**	66·26	33·27	0·23	0·24	**100**
1908 .	135 694	44 966	488	429	**181 577**	74·73	24·76	0·27	0·24	**100**
1910 .	163 057	50 925	2 901	616	**217 499**	74·97	23·41	1·33	0·29	**100**
1912 .	159 288	44 047	8 332	700	**212 367**	75·01	20·74	3·92	0·33	**100**

Note. An altered arrangement of the respective statistics also influences the figures after 1904.

TABLE 28. *Imports and Exports of Cheese.*

Year	Imports, kg				Exports, kg
	Swiss cheese	Dessert cheese	Other kinds	Total	
1901	.	.	.	**363 909**	1 818
1905	.	.	.	**320 496**	4 839
1906	.	.	.	**939 976**	18 461
1907	345 842	47 319	156 370	**549 531**	9 064
1908	265 670	32 884	63 454	**362 008**	3 501
1909	270 137	38 780	43 937	**352 854**	58 766
1910	240 536	35 642	47 128	**323 306**	23 507
1911	255 463	39 678	42 074	**337 215**	2 956
1912	[1] .	61 920	[1] 518 291	**580 211**	5 430

[1] Swiss cheese included in »Other kinds» since 1912 in the Official Statistics.

sociation, which was formed in 1905 and has its business-districts in Malmöhus and Kristianstad Län. In order to make Swedish butter known, and to prevent its being mistaken for the butter exported by other countries, a registered mark for Swedish export-butter — the so-called *rune-mark* (Sw. runmärket) — has been employed since 1904. This mark, however, is not only a national one, but it also shows the quality, as it may only be employed for butter from dairies the butter-tests for which have shown that the cream or the milk employed there for butter-manufacture has been pasteurized to at least 80° C., that the water contained by the butter does not exceed 16 %, and that the quality of the butter is irreproachable. The rune-mark becomes of greater importance every year for the placing of Swedish butter on the English market. It is of growing importance, too, for the sale of butter in the home-market, so that many dairies which do not sell butter for export consider it necessary to endeavour to obtain the right to employ it. Since September, 1911, the highest amount of water contained by the butter has been legally fixed by a Royal ordinance at 16 %, and regulations have been issued respecting the control of this matter; the Board of Agriculture has the task of seeing that the testing is carried out in a proper way. The butter prices are still ruled mainly by the quotations of the Copenhagen market. Since 1897, there has existed a so-called Swedish quotation, too, which, however, is fixed a week later than the Danish and gives the average prices obtained for first-class butter; it is thus, in reality, a market report. *Cheese* is imported and exported, as already mentioned, only on a small scale. The imported cheese consists for the most part of Swiss cheese, which is brought into the country from Switzerland and Germany; some amount of dessert-cheese is imported mainly from France, while other cheese is imported from various quarters, large quantities having been imported during the last few years from the Netherlands.

Measures for the Promotion of the Dairy-Industry.

The State and the various Agricultural Societies have endeavoured in many ways to promote and support the dairy industry.

Teachers and dairy-experts. In the service of the State there is first a State Dairy-Expert, whose duty it is to assist the Board of Agriculture in the performance of its labours and to assist the public with information and advice, and, secondly, an agent in England and another in Germany, who have to work for the extension of the market for Swedish agricultural products in these two

countries. Several Agricultural Societies have appointed *experts* or *dairy-instructresses* (Sw. länsmejerskor), who have not only to supply the public in their respective läns with advice and information respecting the fitting-up and arrangement of dairies, but also to give practical instruction in the manufacture of butter and cheese.

Dairy-schools. At *the Alnarp Agricultural High School* there is a dairy-division embracing a higher course for the training of experts and teachers in dairy-management, and also a lower course for the training of dairy-managers. The conditions for entrance to the higher course are that the candidate shall have passed the final examination at one of the agricultural high schools of Sweden, or have a knowledge of the work corresponding to that which can be gained there, and to have seriously taken part in all the branches of practical dairy-work. For entrance to the lower course the candidate must possess a good certificate from the elementary school, and to have had at least one year's practical experience of dairy-work in all its branches. Both courses last one year. At *Åtvidaberg* there is a *State Dairy-School*, for the purpose of giving men and women who have already had experience in dairying and have acquired some theoretical knowledge of their business an opportunity for the further study of the theory and practice of dairying. Two courses are held every year, each lasting six months. The *State Dairy-Stations* give practical and theoretical instruction to women-pupils, the course lasting two years. These stations, which are established in connection with private, well-managed dairies, possessing the most modern requirements in every part of the country, train annually some 70 dairy maids. The Malmöhus Län Agricultural Society has at Alnarp a *Dairy-School for Women*, which receives every year 6 free pupils, in addition to as many paying pupils as the accommodation permits. The course embraces theoretical and practical instruction in dairying, and lasts 6 months.

Dairy-exhibitions. An important factor in the development of dairying has been the exhibitions of dairy-produce. From 1853—91, these exhibitions were held in connection with the General Swedish Agricultural Meetings, but nowadays the exhibitions of dairy-produce are held separately. As dairying grew more general, the need for more frequent and larger exhibitions was felt, and since the close of the sixties such exhibitions have been pretty regularly held at Malmö, until the close of 1890, for the Skåne Läns, and in Gothenburg, till the close of 1893, for Western and Central Sweden. Later on, these exhibitions resolved themselves into so-called butter-testing meetings, the ordinary trade article at the export towns being taken and submitted to various tests as to quality. General Cheese Exhibitions in conjunction with dairymen meetings were organized in Stockholm by the Board of Agriculture in 1894, 1895, 1899, and 1904; since the year last-mentioned they have been replaced by cheese-stock testings. In addition to the above-mentioned exhibitions, which were on a somewhat larger scale, smaller shows have been held in many places; they are a regular feature of many of the Agricultural Societies, and undoubtedly greatly contribute, within certain restricted areas, to promoting dairy-farming.

Swedish butter-testings. Butter-testings began at Malmö in 1891; since 1893, they have been held at Gothenburg, too. Since 1894, they have had the title of *Swedish Butter-Testings;* they are carried out by means of grants from the Agricultural Societies and the State. The aim of the butter-testings is to ensure the production in Sweden of export-butter of uniform quality, suitable for the foreign markets. For this purpose, the following measures are taken: 1) an examination of the quality of the export-butter in various respects, by means of suitably arranged tests, is carried out with the co-operation of the butter-exporters of the country and the dairy-experts; 2) immediately after each

test, each of the dairies taking part in the testings is informed of the quality of its butter and of the faults that it may possibly possess; 3) a registered butter-mark is provided for the dairies taking part in the testings which have carried out the conditions prescribed, so that the foreign markets may be in a position to recognize Swedish export butter of the very finest quality by its special mark. The direction of the butter-testings, which are carried out under the superintendence of the Board of Agriculture, is in the hands of a committee consisting of representatives of the Agricultural Societies which make grants for the testings, of an administrative committee, and, finally, of a butter-mark committee. The chief manager of the testings and of the butter-marking control is a specially appointed butter-expert.

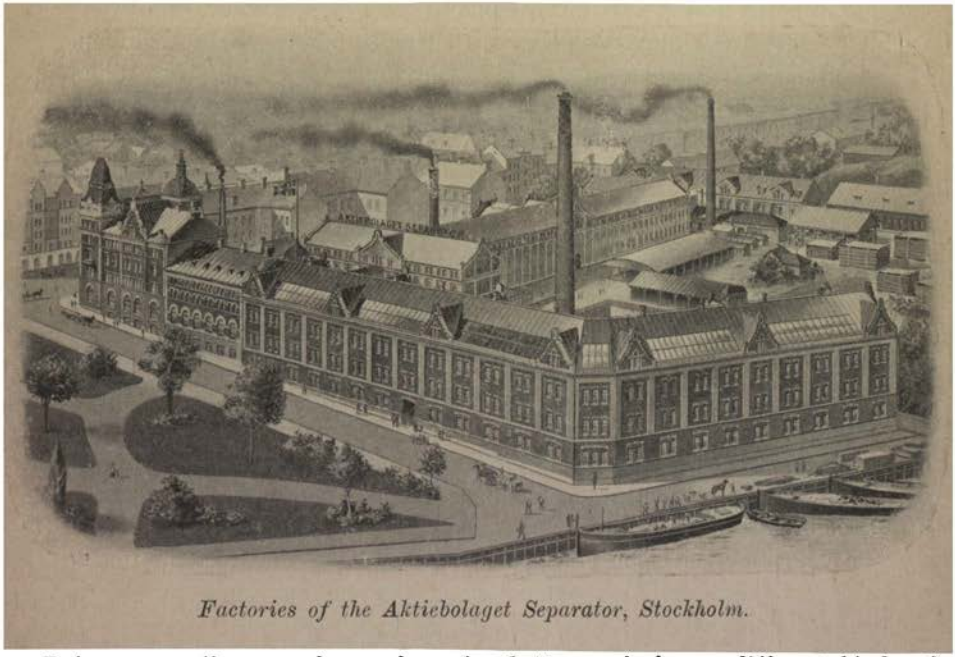
The dairy-section of the *apparatus-testings* at Alnarp assists the dairies in the choice of suitable apparatus and machinery by means of its reports on the results of the experiments carried out. *Dairy- and Dairy-farmers' Associations* are also important factors in the promotion of dairy-farming, and there exist several different varieties. Their object is to bring about discussions on questions relating to dairying, and to procure for their members the advantages accruing from community of purchase and sale, etc. Such associations arose as early as in the seventies, but it is only during the last decade or two that they met with any great support. The dairy-experts and the teachers of dairying have also combined for the protection of their own interests, and to assist in the development of the dairying industry. The union is called The *Swedish Dairy Control Association* and was founded in 1888.

Machines and Implements for Dairy-work.

Nearly all the great number of machines and implements employed in dairying are manufactured in Sweden at different factories and works, which, in many cases, turn out no other class of goods. The manufacture in question has become a very important branch of the industries of Sweden, employing, as it does, thousands of workmen and bringing into the country many million kronor every year. Foremost among these manufacturing concerns stands the *Aktiebolaget Separator*, one of the largest industrial firms in the country, which, in its splendid workshops in Stockholm, turns out principally the well-known Alpha-separators, and also milk-pumps, butyrometers, emulsors, etc. At present the works employ 1 000 men and 60 engineers and clerks. Upwards of 130 000 separators are sold every year, to all parts of the world where dairying is carried on; of this number, the Stockholm works supply about half. The total output is now considerably in excess of 1 300 000 machines. The Company possesses branch-works in America, Austria, Denmark, France, Germany, Hungary, Italy, and Russia. Another important firm in this business is the *Aktiebolget Baltic* established in 1904. The works are situated at Södertälje and employ about 250 men and 25 engineers and clerks; the machines produced are hand- and power separators, and during the last few years the so-called Baltic turbine-dairying-machines, which have very rapidly gained a market in all countries engaged in dairy-farming. The firm exports on a large scale, sales being carried out chiefly through its own branch-offices and works in Riga, Berlin, Sydney, and New York. Separators of different kinds are made at many other works, too, such as *Aktiebolaget Eskilstuna Separator; Aktiebolaget Gävle Separator; Aktiebolaget Pumpseparator,* Stockholm; *Aktiebolaget Rotator,* Södertälje; *Aktiebolaget Salenius verkstäder,* Stockholm; *Aktiebolaget Sveaseparator,* Stockholm; *Separatoraktiebolaget Fama,* Stockholm; *Svenska Centrifugaktiebolaget,* Södertälje.

Vessels and implements of tinned steel-plate, for use in dairies, are made by

the *Kockum järnverksaktiebolag* (Sw. järnverk = iron works), *Wedholms mejerikärlsfabrik* (dairy-vessel factory), *Karlskrona galvaniseringsaktiebolag*, the *Olovström*, and *Eskilstuna stålpressningsaktiebolag* (steel-pressing Co.), etc., whey-cheese boilers and brass and copper dairy-vessels, by the *Skultuna Bruk* (works). Several mechanical workshops manufacture on a larger or smaller scale different kinds of machines and implements, as well as boilers and steam-engines for use in dairies. Among these may be mentioned *C. Holmbergs mekaniska verkstads aktiebolag* (mechanical works) in Lund, a firm which, for a long time past, has made a speciality of the manufacture of all kinds of dairy-machines and implements, and which has also erected and fitted up a considerable number of dairies in other countries in the north of Europe. There are also special businesses for the sale of dairy-implements, etc., such as *Sten Ericsson*, Stockholm; *A. Hollingworth & Co.* Örebro; *Rudelius & Boklund*, Lund; and the *Östergötlands maskinaffär*, Linköping, which supply all the dairy machines and implements in the market, which, in part, are manufactured in their own workshops. These establishments and the workshops just mentioned are prepared to furnish designs and estimates for dairies and undertake their complete equipment.



Factories of the Aktiebolaget Separator, Stockholm.

Dairy-preparations, such as dyes for butter and cheese, different kinds of rennet, cultures, etc., are also made in Sweden, and among other firms by *S. Barnekows teknisk-kemiska laboratorium*, at Malmö. These preparations, as well as the butter-salt employed in the dairies, are imported in considerable quantities.

4. PUBLIC AND PRIVATE INSTITUTIONS FOR THE ADVANCEMENT OF AGRICULTURE.

In the State administration of Sweden, matters referring to farming and cattle-rearing have, up to 1900, belonged to the Department for Home Affairs. That year, however, a special **Department of Agriculture** was instituted, to which were assigned the matters above-mentioned, as well as those of forestry and certain other allied questions. This new department is divided into two bureaus, one of which deals with agricultural matters, the other with forestry. It publishes a serious of "Communications" (Sw. meddelanden) containing accounts of journeys for the purpose of special study, supported by Government grants, reports of the measures taken for the promotion of agricultural economy, fishery investigations, etc.

Before a measure is laid before the Government it is, as a rule, remitted to that Government Office to which is proximately confided the final preparatory discussions and other such work attached to the matter in question. Measures connected with agriculture, the fisheries, etc., are remitted therefore to the **Board of Agriculture,** which further investigates the matter in question and, on the basis obtained by this inquiry, draws up the final proposals which are laid before the Government.

The **Board of Agriculture** was established in 1890, and has the task of attentively following the condition of agriculture and its by-industries, and also of the fishing industry, and, as circumstances require, itself takes, or proposes to the Government, the steps necessary for the promotion of the industries mentioned. This Board consists of a head, with the title of Director-in-Chief, and four members (Bureau Chiefs). In addition to these, a veterinary surgeon is attached to the Board, to direct the investigations respecting tuberculosis among the cattle-stock of the country and the measures taken by the State for combating the disease. The Board of Agriculture makes a yearly report to the Government of the work carried out by the Board itself and its subordinate institutions. This report is printed and published, and the Board also issues a series of "Communications" dealing with matters of importance for agriculture. The regulations now in force for the Board of Agriculture were issued on October 2, 1908.

Before the institution of the Board of Agriculture, the administrative committee of the **Academy of Agriculture** had the task of deliberating on the matters which are now under the control of the Board of Agriculture, so that the Academy occupied simultaneously a scientific and an administrative position, which, consequently, was a peculiar one in many

respects. An account of the organization and present activities of the Academy has already been given (Part. I).

There is a large number of officials under the Board of Agriculture, who have the principal part of their work in various districts of the country. First among these are the **State consultative experts** (Sw. Statskonsulenterna), each of whom has to give the public information and advice in that branch of agricultural economy for which he is appointed, and also to assist the Board of Agriculture in the execution of its duties. There are at present 9 of these officials; one for each of the following branches: cattle-breeding, dairying, pig-breeding, sheep-breeding, small-farming, seed-culture, and the combating of tuberculosis among cattle, and two for home-sloyd. When no State consultative expert for agriculture is appointed, the State, in order actively to encourage the appointment of such experts by the various Agricultural Societies, has made a grant of 62 500 kronor, as a contribution towards the payment of 26 agricultural experts, on the condition that the travelling and subsistence allowances of the experts in question are paid by the Agricultural Societies, the County Council, or some other authority.

Work intimately connected with that performed by the State consultative experts is carried out by the State **peat-officials** — consisting of two peat engineers and three peat-assistants — the State **fisheries officials** — five fishery superintendents, each with his special district; a fishery assistant, a fishery engineer and a fishery bursary-holder, and 23 State **agricultural engineers** — each with his special district — who are assisted by 4 extra agricultural engineers and 5 agricultural bursary-holders. The chief duties of the agricultural engineers are confined, however, to helping farmers in drawing up plans for drainage, the cultivation of new areas, etc.

Among the associations formed for the promotion of agriculture and its by-industries, the **Agricultural Societies** occupy the most prominent place. There will be found on p. 142 a detailed account of their organization, labours, etc.

The Board of Agriculture stands in very close connection with these societies, and has very frequent recourse to them for the investigation of questions concerning the various branches of agricultural economy. Since — as is usually the case — the Board of Agriculture asks for the opinion of all the Societies with regard to any certain question, it obtains in this manner a very good view of the idea of the importance, etc. of the question, held in different parts of the country.

In order to bring about co-operation and collaboration between the various Agricultural Societies, and to give them an opportunity of discussing questions of common interest, representatives of each of the Societies meet every year in Stockholm. From this institution — The **Meeting of the Deputies of the Agricultural Societies** — both the Government and the Board of Agriculture are accustomed to call for expressions

of opinion concerning proposed measures for the promotion of agriculture and its by-industries, and regarding the representations, etc. which have been received as to such measures.

The immediate direction of the horse-breeding of the country, the State studs, and the award of horse-premiums, is exercised by the **Studs Board,** which consists of a Director, two members, a deputy member, and a secretary. For the better performance of its tasks, the Studs Board has the right, whenever it considers it necessary, to summon to its meetings the chairmen of the horse-premium juries, and the director of the Cavalry Remount Board. The Instructions for the Studs Board are dated December 31, 1909.

The budget estimates for 1915 for the *Department of Agriculture* amount to 14 184 700 kronor, 8 017 504 kronor of this amount belonging to the ordinary estimates and 6 167 196 kronor to the extraordinary. A special petition must be made each year to the Riksdag for the grant of the sums shown in the extraordinary budget. Of the amount above, 92 110 kronor are allocated to the Department itself; out of the remaining items, 5 909 020 kronor may be considered as directly intended for the benefit of agriculture. These items are: The Board of Agriculture, 83 400 kronor; for the promotion of agriculture and farming industries in general, 412 450 kronor; agricultural educational establishments, 814 950 kronor; agricultural engineers and assistants, 101 900 kronor; veterinary service 450 020 kronor; the improvement of horse-breeding, 425 200 kronor; the promotion of small farming, 291 500 kronor; draining and ditching, 2 350 000 kronor; reductions in freight-charges for lime for agricultural purposes, 380 000 kronor; and others of greater or lesser amounts. *There are also included in the budget grants for the promotion of the fisheries, 974 700 kronor; forestry, 913 429 kronor; the land-surveying staff,* 787 200 kronor *the Ordnance Survey of Sweden, 357 200 kronor;* geological and hydrographical investigations, 325 105 kronor; repair of roads and posting-service, 1 704 508 kronor; poor-relief, 376 564 kronor; and divers items, 2 744 864 kronor.

The Department of Agriculture has, too, the charge of the following funds, from which grants of loans are made, viz.; the cultivation loan-fund, 1 000 000 kronor, from which loans are granted for draining enterprizes, the lowering of lake-levels, etc. (v. p. 140), the Norrland landreclaiming fund of 300 000 kronor, from which loans are made to County Councils or Agricultural Societies which declare themselves willing to grant loans to small farmers for the cultivation of land suitable for tillage; the draining loan-fund of 200 000 kronor, for promoting the draining of small farms; the "Own Homes" (Sw. egnahem) loan-fund of 7 500 000 kronor, for granting loans for the formation of "own homes"; the land-purchase fund (Sw. jordförmedlingsfond), of 2 000 000 kronor, intended for granting purchase-loans to Agricultural Societies, Companies and Associations, the aim of which is the promotion of the "own home" movement, in order to buy tracts of land for the purpose of cutting them up into "own home" plots; the loan-fund for the purchase of thorough-bred and half-bred brood-mares, of 100 000 kronor, from which Agricultural Societies, within whose districts there exist favourable conditions for carrying on the breeding of thorough-bred horses, can obtain loans intended to be advanced to horse-breeders in the districts in question; the fund for the promotion of the peat-industry, of 1 000 000 kronor, for the erection of peat-litter- and peat-fuel factories, etc., and the fund for the promotion of the fishing industry, of 750 000 kronor, from which fishermen can obtain loans for the purchase of fishing-boats, etc.

From the Crown Lands funds there has been advanced for the year 1915, the sum of 216 200 kronor, for covering the expenses of the Crown Lands Board — wages, disbursements, travelling expenses, etc., 7 603 400 kronor, and 180 500 kronor to cover the expenses of the State Forest and Farm domains respectively, and 1 000 000 kronor, for the purchase of timbered land or land suitable for the growth of timber.

Agricultural Education.

The institutions affording instruction in Agriculture are under the control of the Board of Agriculture and are essentially of four types. *Agricultural schools* (Sw. lantbruksskolor), *Farmers' schools* (Lantmannaskolor), *Schools of Agricultural Economy* (lanthushållsskolor), and *Agricultural High Schools* (lantbruksinstitut).

The first steps for the promotion of agriculture by means of systematic instruction were taken during the 18th century by private individuals imbued with zeal for the economic development of the country. Among these may be mentioned, first and foremost, the Swedish patriot, *Jonas Alströmer*, who, in 1748, extended the sheep-breeding school he had established as early as 1739 on the Höjentorp estate in Västergötland, so as to form a kind of high school of agriculture and forestry, intended for young men who had enjoyed a university education. This educational establishment existed with some State support for about a decade, and was probably one of the earliest agricultural schools in the world.

A new impulse was given in 1834, when *Edvard Nonnen* opened a college at *Degeberg*, near Lake Vänern, on the model of the school at *Möglin*, where Nonnen himself had studied under *Albr. Thaer*. The institute in question continued to exist very successfully until 1853, as a mixed-system college with a higher and a lower division, enjoying State support, and trained, altogether, more than 100 male pupils, many of whom afterwards became pioneers in the Swedish agricultural world. It was from the Agricultural Society of Örebro Län that the plan issued for the earliest actual lower-grade agricultural school, giving theoretical and practical instruction — chiefly the latter. The school, which was on the Dyringe estate, continued its labours during the years 1813—18, but was then obliged to close, on account of financial difficulties. However, after the good results of the separate repartition of land, together with the rise in the price of grain, had begun to awaken hopes of the possibility of development in the domain of agriculture, under the presumption that the farmers possessed greater knowledge and practical ability, numerous proposals were made for the establishment of agricultural schools, intended principally for the training of farm-managers. Finally, the Riksdag was found willing to support the establishment of such schools, and the first State-supported school was opened in 1840, on the *Orup* estate, in Skåne, soon succeeded by many others in various parts of the country. The zealous promoter of this school and its director for some years was *Johan Rabbén*, (titular professor), the first Swede educated at a University who devoted himself to teaching agricultural economy. In the middle of the 18th century, it was imagined that the higher instruction in agriculture could be promoted by establishing chairs at the University, in "res rustica et agricultura", but these were soon done away with as they did not lead to any positive result.

A good many years passed, however, before Sweden obtained a *higher agricultural educational institute* established by the State itself, viz., that of *Ultuna*,

near Uppsala, founded in 1848, and that at *Alnarp*, near Lund, opened in 1862. The respective founders and the principals for many years of the two institutes were *Johan Arrhenius*, at Ultuna (1848—61), and *Hjalmar Nathorst*, at Alnarp (1862—86). Both of these men greatly promoted the development of Swedish agriculture.

During the seventies there arose as an extension of the People's High Schools (p. I, 378), so-called *Farmers' Schools* giving exclusively theoretical instruction. These were recognized officially in 1887, and in the same year there was opened at *Vilan*, in Malmöhus Län, the first farmers' school supported by the State. Its director was *L. Holmström* (1887—1908). During the last few years, new regulations have been issued for the various schools, in addition to which entirely new measures have been taken to provide the great numbers of *small farmers* of Sweden with suitable instruction in agriculture. Special schools have also been established for young women, under the title of *schools of agricultural economy*.

Photo. Ionn, Malmö.

The Farmers' School at Vilan.

The aim of the **Agricultural Schools** is to impart instruction in the principles of practical agriculture, and to afford practice and skill in the arrangement, direction, and performance of farm-work.

The instruction is given:

a) in a *two-years' course*, specially intended for the training of farm-managers;

b) in a *one-year's course*, intended to provide young farmers with general practical and theoretical instruction in agriculture. The courses begin each year on November 1. An agricultural school must be situated on a large estate, with the owner of which an agreement has been made. In the two-years'

course, at least 200 hours shall be employed in giving preparatory instruction in spelling and writing, arithmetic, and natural science; during the second winter half-year, at least 880 hours shall be employed in theoretical instruction in agricultural subjects proper.

The pupils in the one-year's course shall also take part in the above instruction. The pupils have to take part in all kinds of farm-work and shall also act as farm-managers; the training of farm-managers can, as a matter of fact, be regarded as the chief mission of the agricultural school. Every such school shall accommodate 20 pupils in the two-years' course and 8 in the one-year's course.

There are special regulations for the agricultural schools in Norrland and Dalarne, the theoretical-practical course continuing there only one year while, in addition, there is a theoretical winter course. Both courses begin on November 1. The first common regulations for the agricultural schools were issued on January 14, 1851. The new regulations have been in force from November 1, 1912. Up to the present, agricultural schools have existed in most of the läns of Sweden, but, in future, their total will be restricted to 9, in addition to the 2 at the agricultural high schools and the 4 in Norrland. The first-named schools receive an annual State grant of 7 500 kronor; those in Norrland, 6 000 kronor. In 1914 there were 14 agricultural schools with a total of 381 pupils.

Farmers' Schools are intended to give a knowledge of the principles of agriculture, chiefly with a view to the conditions obtaining on middle-sized and smaller farms. The new regulations for these schools date from 1 November, 1912.

The farmers' schools, as was mentioned above, were originally a higher division of the People's High School and, hitherto, have all been of the same type. According to the new regulations, however, these schools can be established according to one of two forms, which differ in the instruction given:

Farmers' schools, A, corresponding to the original farmers' schools, and the *Farmers' schools, B*, which, in accordance with their purpose, can be characterized as schools for the small farmer. In both these types of schools, but in varying degrees of course, there shall be given theoretical instruction in 1) *rudimentary subjects*, such as the Swedish language, arithmetic, geometry, natural science, biology, geology, etc.; 2) *principal subjects*, the science of agriculture, the study of domestic animals, dairy-farming, the care of cattle in sickness, farriery, agricultural economy and book-keeping, and 3) in a number of *subordinate subjects* such as gardening, forestry, surveying, levelling, linear-drawing, the principles of communal self-government, etc. The term shall last at least 20 weeks, and the pupils must be able to visit a well-managed estate for demonstration purposes. The pupils must themselves pay for their board, together with a certain fee for tuition. Under certain conditions the annual State grant can amount to 6 000 kronor; the fixed grant is 2 000 kronor. The sum that can be received in excess of this last-mentioned grant depends on the number of pupils, and also on an equal amount being received from the place itself, inclusive of pupils' fees. The Agricultural Society of the provincial län shall also state that the school is required in the district.

The farmers' schools are chiefly attended by young men who intend to become owners of farms, and who have received practical training in their parents' homes, or as working-pupils on private farms. Many young men, however, obtain sufficient theoretical training at the farmers' schools to be able to take positions as managers or bailiffs, or to farm large estates privately. Young women, too, can obtain admission to these farmers' schools, and also to the agri-

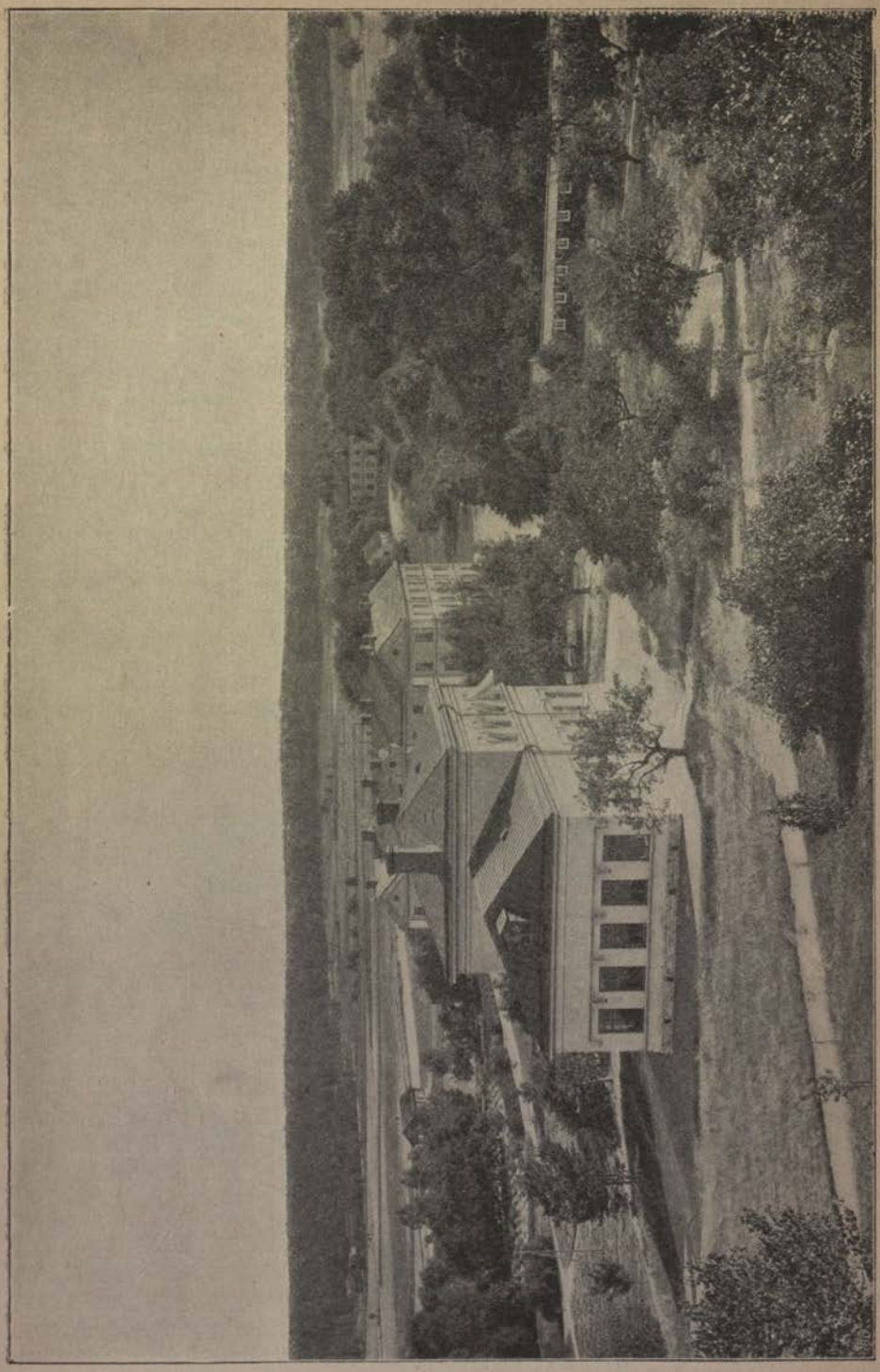


Photo. ALFRED DAHLGREN, Uppsala.

The Ultuna Agricultural High School.

cultural high schools. In 1914 there were 940 young men enjoying instruction at the 37 farmers' schools of Sweden. At several farmers' schools, courses are arranged for the training of *assistants in cow-testing*. These courses last 6 weeks and receive a State grant. In 1914 there were 320 assistants thus trained. During the last decade, the small farmer has been provided with instruction and encouragement in many ways. The beginning of this movement was made by the People's High Schools taking the initiative to the arrangement of short *courses of instruction for small farmers*, (Sw. småbrukare). Similar independent courses, receiving State grants, are nowadays arranged by the Agricultural Societies; they usually last from a few days to one or two weeks, and consist of lectures, demonstrations, and discussions between teachers and pupils in common. The pupils, who are often elderly men, enjoy free tuition; many of them, too, being granted free board and lodging as well. Short courses are arranged for the wives of small farmers, too, with a course of instruction suited to the needs of the pupils.

The extent and importance of these courses may be seen from the fact that, in 1914, there were held 24 courses with 12 days' instruction, 152 courses with 6 days' instruction, and 124 courses with a shorter period of instruction; or, altogether, 300 courses. The State and the Agricultural Societies contributed together 70 759 kronor 73 öre towards the expenses of these courses.

In this connection may be mentioned the State-supported *travelling studentships* (Sw. studieresor), the journeys being made under the guidance of some trained farmer or an agricultural expert, and with the support of the Agricultural Societies, or some other authority, to other parts of the country — or even to Denmark — where anything instructive can be found worth seeing or hearing. Each journey usually lasts one or two weeks and there are about 20 participants. In 1914 there were 55 such journeys made, several of them being for women, with a total of 810 pupils. The grants received from the State and the Agricultural Societies amounted to 60 999 kronor 55 öre.

Of great importance is the *work performed by the agricultural experts*, appointed during the last few years. In every län there are one or several thoroughly trained experts, whose task it is to give advice and information to agriculturalists. *Ambulatory teachers* and *farming instructors* are also employed for the purpose of giving small farmers guidance in the measures necessary for the promotion of agriculture.

The **Schools of Agricultural Economy** have as their mission the imparting to young women of practical and theoretical instruction in household economy and the farmwork executed by women in that part of the country where the several schools are situated.

The schools of agricultural economy, which really did not begin their work before November, 1912, will probably be established in connection with People's high schools and farmers' schools. Each course must last at least 12 weeks, and the course of instruction is to embrace 1) *practical instruction* (with exercises and demonstrations) in cookery, baking, and the utilization of the meat, etc. of slaughtered animals; preserving, washing, and house-cleaning, dairying, gardening, care of the smaller farm-animals, and of cows in connection with milking. All this instruction shall be accompanied by practical exercises, when this is possible without inconvenience. 2) *Theoretical instruction* respecting articles of food and the like; simple book-keeping and calculation of household expenses proportionate to incomes of various amounts; hygiene and the care of the sick and of infants; the elements of gardening and the management of domestic animals. The school of agricultural economy must have access to a farm of suitable size,

and can receive a State grant for each course of instruction amounting to 1 800 kronor, the lowest grant made being 1 000 kronor. In other respects, the conditions are the same as for the farmers' school.

Schools of agricultural economy of a higher class are the schools established by the Fredrika-Bremer Society at Rimforsa in Östergötland, and the Uppsala School for Household Economy on its estate called Brogård, both of which are intended for a two-years' course of training, both practical and theoretical, for *women teachers* of household and agricultural economy. Both schools enjoy State grants.

Among the entirely private schools in Sweden imparting instruction in agriculture may be mentioned the Northern School of Agriculture, at Hagaberg near Jönköping, and the Skåne School of Agriculture, at Dala in Malmöhus Län. *P. J. Rösiö*, the Director of the first-named school has made himself known for his enthusiastic and effective work as a lecturer in the country districts of Sweden.

The educational establishments described above, viz., the agricultural schools, the farmers' schools and the schools of agricultural economy, like the People's High Schools, have originally arisen from private initiative, and even at the present time are not the property of the State, but are owned by private individuals or Associations guaranteeing the payment of the expenses, or by the County Councils and the Agricultural Societies. They have, in consequence, been able to develop fairly independently, and in accordance with the greatly varying conditions existing in different parts of the country. There exists a regulation common to the two last-named classes of schools, viz., that the State grant can only be obtained on certain conditions. The principal are, that the school shall be under the direction of a Board; the principal and the chief teachers shall possess certain qualifications (they must have passed the examination for "agronom" or trained agriculturalist; see below); the course of instruction must be of a certain minimum length; there must be a certain number of pupils; the local authorities must certify that the school is necessary; the school must possess an income equal to the amount of the State grant, over and above the so-called fixed grant (Sw. grundanslaget); a certain number of pupils shall enjoy free instruction; the minimum age of the pupils must be 18 years (women may be as young as 16, however); the pupils applying for admission to the farmers' schools shall have taken part in agricultural work for the space of one year, and, finally, a report of the work of the school shall be sent every year to the Board of Agriculture, which is to fix the course of instruction.

State grants in aid of pupils possessing small or no means amount, at present a) at agricultural schools to 60 and 100 kronor respectively; b) at farmers' schools, schools of agricultural economy and the theoretical winter-course at the Norrland agricultural schools, to 15 and 25 kronor respectively per month, and c) to 1 krona per day for small farmers taking part in the two-weeks' courses. The total sum devoted to the above grants is 70 000 kronor.

Inspection of all the lower grade agricultural schools is carried out in accordance with the Royal Regulations of June 29, 1912.

The agricultural schools are governed by the Regulations dated October 19, 1911 and Febr. 28, 1914.

The Farmers' schools and the Schools of agricultural economy are governed by the Regulations of June 10, 1912, and, as regards the grant to these institutions, by the Royal Proclamation dated June 29, 1912.

Respecting experts and ambulatory farm-bailiffs, see the Royal Proclamation dated Oct. 19, 1911.

The **Agricultural High Schools** have as their object the imparting of instruction in agriculture, based on scientific investigation.

The High Schools embrace the following courses:

1) *A two-years' course* intended to give instruction in the theoretical principles necessary for a rational method of agriculture, and 2) *a one-year's experts' course*, consisting of a continuation course based on the former one for agriculturalists (Sw. agronomer), and intended for the training of experts and teachers of farming. The course for experts is divided into two lines: a) one principally for the training of experts in the *land-farming branch;* b) principally for the training of experts in the *cattle-farming branch.*

At Alnarp there is a third line for *dairy-farming.* The subjects of instruction are those commonly taught at every higher agricultural school. The study of pedagogics is one of the subjects in the course for experts.

As far as possible, the instruction must be given in connection with the agricultural economy of the large landed properties of the State at Ultuna and Alnarp, where the two High Schools are situated.

In order that the pupils may derive as much benefit as possible from their training, the High Schools are provided with the following establishments:

a) An agricultural experimental field.

b) A botanical garden.

c) An economy garden (Sw. ekonomiträdgård) and nursery.

d) A laboratory for practical experiments in physics, chemistry, botany, and bacteriology.

e) An anatomy room, and stalls for sick animals.

f) Museums, with materials for instruction.

g) A library.

Alnarp also possesses a farriery school and a dairy-farming school.

The school-year begins on November 1; the vacations last altogether 12 weeks.

The *teaching staff* consists of eight *lectors*, and *adjuncts* or assistant masters. One of the lecturers (Sw. lektor) is appointed *Principal* (rektor) for a period of five years, and has the task of superintending and directing the school. The farm belonging to the High School is managed by a *Steward* under a Board of Directors, which superintends both the school and the estate. The steward is the head master of the agricultural school attached to the estate.

At each high school there shall be places for not less than 44 pupils, 4 of whom shall be free scholars, and for 2 pupils that intend to become agricultural engineers. In addition, there shall be places for 6 pupils in the course for experts.

Paying pupils are charged 100 kronor yearly for instruction-fees and 75 kronor for rooms; board is paid for in accordance with a scale fixed by the directors. Free scholars pay nothing for any of these things.

The requirements for admission to the course for agriculturalists are:

a) The applicant for admission must be not less than 18 years of age; b) he must have had at least two years' practice in farming; c) he must possess a certain (modern school) degree of knowledge corresponding, at least, to a "pass" in the "realskolexamen", or to that possessed by a pupil in the "secondring" (upper sixth class) at a State secondary school, in Swedish, German, mathematics and natural science. Applicants can also send in certificates showing that they have reached a corresponding standard of knowledge, the said certificates to be submitted to the Board of teachers for investigation and approval.

Many of the pupils prove to have passed the matriculation examination. A good preparation has been found to be previous attendance at a People's high

school and a farmers' school (A) and, in addition, a winter-course at the so-called "upper division" of a couple of People's high schools which impart instruction in Swedish, German, mathematics, physics, and biology.

Applicants for admission to the experts' course must have passed the course for agriculturalists and have obtained at least distinction in certain of the principal subjects, besides possessing a good knowledge of German.

The Agricultural High Schools are real *State institutions,* situated on farms belonging to the State.

The members of the Board of each High School are appointed by the Government, and the lectors, too, are nominated by the same authority; the assistant masters, on the other hand, are appointed by the Board.

During 1914, the total number of pupils at both High Schools together was 120.

The Agricultural High Schools are governed by the Regulations of Aug. 12, 1912.

Farriery Schools: In addition to the institutions for teaching agriculture should also be mentioned the *farriery schools.*

At present there are three such schools: at Stockholm, Skara, and Alnarp. That at Alnarp was established in 1863 on the initiative of *O. Pehrsson-Bendz,* a pioneer in the field of rational farriery. Up to 1913, it was supported by the Agricultural Society of Skåne Län, but since the beginning of the year mentioned it has been in enjoyment of a State grant, the same as the other two schools have. The *military farriery courses* formerly held at this school are now given at the various regimental stations.

At the farriery schools of the Veterinary High School, Stockholm, which, as far as buildings and appliances are concerned, is the principal one in Sweden and is fully equal to the best farriery schools abroad, there are held every year two courses, each lasting 3 ½ months, for the training of civil farriers ("capable of performing farrier's work unaided"). From 10 to 12 pupils can be received in each course, the requirement for admission to which is a knowledge of smithing (the pupil must have worked at least one year in a smithy). In future, 4-months' courses will be held for the training of military farriery instructors. The pupils taking part in these courses are farrier-corporals, or non-commissioned officers who have previously gone through a military farriery-course and have afterwards served with a cavalry regiment.

At the *Skara Veterinary establishment* two courses are held yearly; one a four-months' course for civil farriers, and the other a course of equal length for training military farriery instructors.

At *Alnarp* there are three courses of three months each every year, intended for the training of civil farriers.

For the exercise of the farrier's profession, it is not necessary in Sweden to have enjoyed a course of instruction in farriery and to have passed an examination, but anyone may carry on the business of a master-farrier.

* * *

For instruction in **dairy-farming,** see p. 118.

Veterinary Service.

Administration. The veterinary service of Sweden is under the superintendance of the *Royal Medical Board* which, in collaboration with the Governors of the various läns, is entrusted with its direction, in accordance with the regu-

lations issued for the Board dated Dec. 31, 1900, and also with certain ordinances relating specially to the veterinary service. Since 1901 a veterinary surgeon has been an ordinary member of the above-mentioned Royal Medical Board and since 1905 this official has been assisted by an amanuensis, also a veterinary surgeon. Since the beginning of 1914 he has also been assisted by a Bureau veterinary surgeon.

In accordance with a Royal Rescript of June 17, 1908, the Royal Medical Board of Health possesses a special establishment called "*The State Veterinary Bacteriological Institute*" (Statens veterinärbakteriologiska anstalt), which, at present, is at the Veterinary High School, for the purpose of carrying out scientific investigations and other work falling within the province of veterinary science, especially bacteriology and pathological anatomy.

The combating of cattle-tuberculosis, as far as this is carried out by means of tests with tuberculine and the measures in the farm-yards which are involved by these tests, is in the hands of the *Board of Agriculture*. Since the year 1908, this Board has among its members a certified veterinary surgeon, in the capacity of provisional member, whose task it is to report on tuberculine measures. He is assisted by another veterinary surgeon as expert in matters to do with tuberculosis.

Certain preparatory measures in connection contagious cattle-diseases lie in the province of the *Chairman of the Local Board of Health* and of the *Communal Boards* in the various parts of the country.

The **training of veterinary surgeons** is carried out at the *Veterinary High School* in Stockholm (Regulations of Oct. 30, 1914.) The High School is superintended by a Board of Directors, consisting of five persons appointed by the Government. During 1913 the instruction at the High School was given by 15 teachers, viz., 5 professors, 2 lectors, 1 adjunct, 4 experimenters, 1 extra teacher, and 2 assistants. During 1913 the number of pupils amounted to 117 in all. During the year in question 16 pupils passed the complete examination for veterinary surgeons. The course is calculated to cover 4 years, but, as a rule, 5 years are required to pass the examination.

The **veterinary establishment at Skara,** the oldest veterinary school in Sweden, was founded in 1772 and subsisted until 1889 when it ceased to be a veterinary training institution and was reorganized as a farriery school, with a veterinary surgeon at its head.

Course for candidates for the post of län (provincial) veterinary surgeons (Länsveterinäraspirantkurs). In accordance with the regulations of the Royal Rescripts of Nov. 22, 1901, and Oct. 23, 1908, and with the circular issued on Jan. 15, 1909, by the Royal Medical Board based on these rescripts, there is arranged every third year at the Veterinary High School a special course for the purpose of training certificated veterinary surgeons in the subjects which are of special importance for future provincial veterinary surgeons.

In accordance with the instructions for veterinary surgeons now in force, and dated Dec. 31, 1912, only such pupils as have gone through this course and passed the examination which concludes it shall be competent to apply for a post as provincial veterinary surgeon.

Every now and then, "*repetition-courses*" for *veterinary surgeons of long standing* are given at the expense of the State. These courses, too, are held at the Veterinary High School.

Travelling studentships. In 1904, the Riksdag granted a sum of 2 200 kronor, to be awarded yearly as bursaries to certified veterinary surgeons who wish to pursue their studies abroad.

The organization of the veterinary service. In the 24 läns of Sweden there are 32 provincial veterinary surgeons, one in each of 16 läns and two in each

of the other 8. The provincial veterinary surgeons have the superintendence of the veterinary service, each in his own district. The duties of the provincial veterinary surgeons are given in the above-mentioned instructions for veterinary surgeons. The provincial veterinary surgeons are paid by the State. The salary amounts to 1 500 kronor per annum, and the service-pay to 1 000 kronor per annum. After 5 years' service, the salary can be increased by 500 kronor, and after 10 years' by an additional 500 kronor. The pension of a provincial veterinary surgeon amounts to 2 500 kronor per annum and begins on his reaching 65 years of age and completing 25 years of service.

In Sweden there are also 182 *district veterinary surgeon districts*, to which the State, in accordance with the decision of the Riksdag of 1912, contributes 600 kronor per annum towards the remuneration of each district veterinary surgeon, in addition to 200 kronor increase after the completion of 5 years' service. This is given on condition that the respective County Councils engage to pay the district veterinary surgeons not less than 1 200 kronor a year, with an extra 200 kronor per annum to those that have completed the necessary term of service.

In a great number of towns there are also appointed one or more *town veterinary surgeons*, whose principal task is to inspect meat offered for sale and to see that the statute of public health are observed in such matters as concern the keeping of cattle in towns, etc. Among the town veterinary surgeons may also be reckoned the *veterinary directors* and the *other veterinary officials at the public slaughter-houses* and at the *public cattle-markets*.

For the purpose of inspecting the health of the cattle imported into Sweden, the Royal Medical Board has appointed *quarantine veterinary surgeons*, stationed at a number of ports where there exist quarantine sheds for cattle. The *export inspection veterinary surgeons* appointed by the same authority have the task of seeing that no cattle which are diseased or otherwise unfit for export from Sweden are allowed to leave the country.

In addition to these officials, there are 6 *civil veterinary stipendiaries*, appointed by the Royal Medical Board, whose task it is to assist that body in combating any cattle-disease that may happen to break out. The *total number of veterinary surgeons* in Sweden at the close of 1914 amounted to 428.

The principal tasks of the State Veterinary Service are:

1) *To combat infectious cattle-diseases* — with the exception of tuberculosis — in Sweden. The legal measures that can be taken in this respect are regulated principally by the Royal Ordinance of December 9, 1898 — with the alterations made therein by the Royal Proclamations dated March 1, 1903, and November 3, 1906 —; the Royal Proclamation of November 3, 1906, respecting swine-fever, swine-plague, and swine-erasypelas, and that of September 28, 1906, respecting the measures to be taken against chicken-plague and chicken-cholera.

2) *To combat cattle-tuberculosis.* The present existing struggle against cattle-tuberculosis in Sweden dates from the beginning of the "nineties", or the time when Koch's tuberculine was proved to be a reliable means of discovering this disease at its very onset. Since that time, an energetic and clear-sighted struggle for the eradication of this plague of the farm-yard has been carried on in Sweden. This work has principally been based on the detection of the existence of the disease, this being done by means of the so-called tuberculine tests, but steps have also been taken to protect the growing generations of cattle from infection. This struggle has been supported by State grants, which, for the year 1913, were estimated to amount to 90 000 kronor; and, as stated above, it has been directed by the Board of Agriculture.

The Royal Medical Board, in accordance with the Royal Ordinance of May 1, 1903, has been entrusted with the task of superintending the struggle against

that form of cattle-tuberculosis which is shown by morbid changes in the udders of milch cows, i. e., the so-called *mammitis-tuberculosis*. In 1911 there were killed 224 animals affected with mammitis-tuberculosis, the owners receiving a total sum of 26 578·10 kronor, in compensation, or an average of 118·63 kronor, per head.

3) *The superintendence of the import and export of cattle and certain wares.* The geographically isolated position of Sweden has had the result that the country, on the whole, has been spared serious outbreaks of cattle-diseases. As, in the very great majority of cases, the infection cannot be communicated otherwise than by means of animals — the general case — or by certain wares, there exist exceedingly strict rules regulating the import of cattle and the wares in question. For example, on the outbreak of any serious cattle-epidemic abroad, all import of cattle from the countries affected is forbidden. The principal regulations in force in this connection are the Royal Ordinances of February 4, 1898; of December 9, 1898; of September 28, 1906; of July 13, 1909; of June 22, 1911; of January 19, 1912 — two rescripts — and of March 19, 1912.

It is of the greatest importance, too, for the maintenance of the reputation of Sweden as a cattle- and meat-exporting country, to see that no animals or meat is sent abroad that can give rise to justifiable complaints in the importing countries. In consequence, as has been mentioned above, strict regulations have been issued respecting the control of the export of cattle and meat; they are found principally in the Royal Ordinances dated November 29, 1906; January 29, 1909; July 13, 1909, and December 6, 1912.

4) *To inspect the articles of food offered for sale in Sweden.* This is regulated by the statute of public health for the whole country, dated September 25, 1874, the law of December 22, 1897 — revised by the Riksdag in 1913 — the Royal Proclamation dated December 31, 1897, and the Proclamation of the Royal Medical Board dated November 2, 1911.

The above is merely a brief account of the present condition of the Swedish veterinary service. Those interested in the matter are referred to Kjerrulf and Regnér: "Collection of Statutes, etc., respecting the civil veterinary system in Sweden" (Författningar m. m. ang. det civila veterinärväsendet i Sverige, Stockholm, 1912), or Kjerrulf and Ringdahl "The civil veterinary service in Sweden" (Det civila veterinärväsendet i Sverige), Stockholm 1910.

Agricultural Credit Establishments.

The Palmstruch Bank, the oldest in Sweden, obtained in 1656 the royal privilege to advance money on "palaces, estates, land, fields and meadows, etc." *The Bank of Sweden* (Sveriges Riksbank), founded in 1668 — its predecessor, the Palmstruch bank, having ceased to exist, — undertook loans on security of landed property.

At the beginning, loans were advanced for short periods but they gradually developed into standing ones. Hence, the funds of the Bank came to be locked up to far too large an extent. In order to facilitate the banking business without considerable prejudice to agriculture, the "Secret Committee" of the Riksdag, in 1752, decreed that a yearly instalment of capital should be paid in the case of loans of ten years' standing. A system of amortization was hereby established, which in 1779 became law, with the decree of a general reduction of 2 % per annum, until the whole debt was paid off. This remained in force till 1859, when the amortization payment was increased to 3 % per annum. At first, the interest was 8 %, but fell in 1687 to 6 %. In 1741, the interest

on loans secured on estates in fee-simple and country freeholds was reduced from 6 to 5 %. In 1756, there was a further decrease to 4 %, irrespective of the nature of the taxation to which the estate was subject. This decreased rate has become fixed. The limit of the loans was one-half or two-thirds, and, in some cases, three-quarters of the value of the estate. From 1770 to 1815, no loans were granted on agricultural property, the Bank having no funds available for the purpose.

The difficulties which arose for the Bank of Sweden from having its funds locked up in agricultural loans of long standing gave rise to the establishment of the **Mortgage Societies** (Hypoteksföreningar). The Mortgage Society of Skåne was founded in 1836. Then came that of Östergötland in 1845, of Småland in 1846, of the Mälarprovinserna in 1847, of Örebro Län in 1849, of Värmland in 1850, of Älvsborg and other Läns in 1851, and of Gottland in 1853. Those of Gävle—Dala and of Norrland followed later on.

The Mortgage Societies were, to begin with, private institutions independent of each other, which, by the sale of their bonds, chiefly aimed at obtaining amortization loans for their members on the security of first mortgages on real property. Mutual rivalry on the bond market, however, proving mischievous in its consequences, the **General Mortgage Bank of Sweden** was founded, agreeable to the ordinance of April 26, 1861. Its chief mission was to negotiate all the loans required to procure the Mortgage Societies means for their loans. Moreover, a loan of about 6 million kronor was made over by the Bank of Sweden to the Mortgage Bank, on security of mortgage in landed property. The Mortgage Bank obtained the monopoly of issuing bonds payable to the holder against security of mortgage on real rural property, and the State handed over to it a capital-stock of 8 million kronor in Government bonds. By the enactment of May 16, 1890, this capital-stock contributed by the State was increased to 30 million kronor.

The Mortgage Bank is administered by a *Board* of five members, of whom the president is appointed by the Government, the vice-president by the Commissioners of the National Debt Board, and the remaining three by deputies from the Mortgage Societies. Of the five auditors, one is elected by the National Debt Board and the other four by the Societies. In the regulations of the Bank, which are sanctioned by the Government, no alterations can be made without the consent of the Riksdag.

The Mortgage Societies, too, are administered according to statutes sanctioned by the Government. They are allowed to grant loans against security in land only, the value of which is estimated according to the appraised value, based on the assement value or on a special estimate made on strict principles and without allowance being made for the value of houses or forest. A loan must on no condition be granted exceeding half of the assement value or the value estimated in this way.

The present conditions for new loans are: *a*) 4 % interest and 1/2 % amortization; *b*) 4 % interest and 2 % amortization; and *c*) 4 % interest without amortization. In each case the borrower has the right to give notice of repayment after ten years. With *a*) and *b*) loans can be granted up to half the value of

TABLE 29. *The General Mortgage Bank bond loans on the 31 December 1913.*

Bond loans			Amortization		Right to increase amortization-rate, or repay balance of loan, from year	Bonds in circulation 31/12 1913, kronor	Present rate of interest, %
Date	Original rate of interest, %	Currency unit in which issued and original amount	Began in	Ends, in ordinary course			
1877	5	Kr. 50 000 000	1888	1927	—	8 644 400·00	5
1880	4½	Kr. 75 000 000	1882	1956	1907	38 480 800·00	4
					1907	14 646 600·00	3¾
1883	4½	Kr. 50 000 000	1885	1959	—	23 784 800·00	4
					1907	15 446 000·00	3¾
1878	4	Kr. 120 000 000 (M. 135 000 000)	1884	1959	— —	101 625 066·67	4
1879	4	Kr. 36 000 000 (Frs 50 000 000)	1880	1939	—	20 874 600·00	4
1908	4	Kr. 10 800 000 (Frs 15 000 000	1909	1968	1918	10 557 000·00	4
1909	4	Kr. 10 800 000 (Frs 15 000 000)	1911	1970	1919	8 461 440 00	4
1910	4	Kr. 15 000 000	1912	1976	1920	6 995 000·00	4
1886	3½	Kr. 64 000 000 (M. 72 000 000)	1888	1962	1901	32 968 266·67	3½
1889	3½	Kr. 75 000 000	1890	1959	1898	17 653 800·00	3½
					Total	**300 137 773**·34	

Rem. The foreign values are given in kronor at par.

the estimate; with *c*) only to one third. According to the position of the bond market, loans are granted against capital-discount (Disagio). Nowadays this capital-discount is deducted on advancing the loan.

The members of each society (i. e. the borrowers) are conjointly responsible for the bonds of the society, each one in proportion to the amount of his remaining debt to the society. The societies are conjointly responsible for the bonds of the Mortgage Bank, each in proportion to its remaining debt to the Bank.

The Bank's annual report gives a survey from which the following extract is made of the *bond loans* raised by the Mortgage Bank, which, at the close of 1913, were not fully amortized;

The amounts of the *loans advanced* to the Societies from year to year are shown by the following extract from a table drawn up by the auditors respecting the loans obtained by the Mortgage Societies from the Swedish General Mortgage Bank, from 1861 to 1913.

Year	Kronor	Year	Kronor	Year	Kronor
1861	16 053 755·54	1874	12 519 174·76	1887	6 304 331·41
1862	22 294 287·00	1875	11 794 536·86	1888	2 562 694·13
1863	8 611 197·52	1876	11 312 389·40	1889	1 640 865·59
1864	1 231 286·57	1877	6 606 451·80	1890	8 868 673·87
1865	3 163 580·62	1878	17 880 686·35	1891	24 822 265·60
1866	2 008 606·73	1879	28 542 331·16	1892	13 325 198·68
1867	8 161 713·71	1880	21 817 038·01	1893	11 884 702·67
1868	9 219 954·53	1881	18 804 155·96	1894	8 543 687·52
1869	16 937 158·37	1882	13 015 479·08	1895	7 265 088·92
1870	13 374 200·60	1883	10 256 427·30	1896	6 610 295·34
1871	12 591 081·89	1884	10 297 188·07	1897	10 048 945·76
1872	15 634 167·20	1885	10 480 523·36	1898	11 369 601·67
1873	8 496 388·16	1886	8 099 598·61	1899	20 006 534·89

Year	Kronor	Year	Kronor	Year	Kronor
1900	10 904 708·77	1905	19 403 430·11	1910	19 474 050·70
1901	8 589 070·02	1906	17 611 155·54	1911	14 128 444·62
1902	13 678 806·18	1907	11 752 405·51	1912	19 032 110·32
1903	15 968 497·33	1908	26 611 278·78	1913	14 499 534·90
1904	21 272 817·09	1909	18 181 039·47		
				Total	683 563 594·55

Deduct: loans repaid	309 959 684·35
Original loan-total on the 31 December, 1913 amounted to	373 603 910·20
Amount amortized:	
On the 31 December, 1913	76 127 072·97
The *net* amount of the loan on the 31 December, 1913	**297 476 837·23**

A comparison between the value of the estates securing admission to the Mortgage Bank, the amount to which the land-owners had the right to borrow, the original loan-capital, and the value and number of the outstanding loans on the 31 December, 1913, is shown by the auditors' report, as given in Table 30.

The amount of the existing loans, therefore, amounts to not quite 34 % of the estimated value of the estates.

Superintended and supported by the State, the Swedish General Mortgage Bank has won great public confidence, and its credit is exceedingly good. Its bonds, too, have long been quoted at prices which are approximately the same as those of the Swedish Government Stock. From Table 29 it is seen that the Mortgage Bank reserves the right, from the year 1889, to give notice of redemption of its bond loans 10 years after the loan has been granted, while earlier loans were locked up for from 24 to 81 years, and one loan, indeed, cannot be called in at all.

This change in the loan-policy has been made in order to confer on the participating Societies the same right in this matter as that possessed by the Bank, whereby, again, the Societies would be enabled to give

TABLE 30. *Value of Estates and the Amounts of the Loans granted by the Swedish General Mortgage Bank; 31 Dec., 1913.*

Mortgage Society	Value of estates whereby admission was gained	Actually granted loans			Total number of outstanding loans
		Amount up to which loans on these estates can be granted	Original amount	Remaining after deduction of annual instalments	
	kronor	kronor	kronor	kronor	
Östgöta	144 174 628·53	57 915 800·00	55 893 600·00	44 316 103·51	7 923
Småland a. oth. prov.	168 759 503·00	83 240 200·00	81 174 900·00	60 560 719·74	20 733
Värmland	37 491 800·80	16 265 745·00	15 187 790·00	10 931 770·64	2 429
Mälarprovinserna . .	84 213 557·00	34 970 200·00	34 355 300·00	28 310 998·58	2 922
Skånska	212 921 185·00	87 402 950·00	86 547 750·00	76 805 838·04	8 632
Älvsborg a. oth. läns	109 964 220·00	54 982 110·00	54 905 910·00	41 304 798·45	14 330
Gottland	21 412 490·00	10 454 810·00	8 540 460·00	5 656 444·12	2 650
Gävle—Dala	22 238 431·00	9 284 800·00	9 233 500·00	7 183 808·25	2 192
Norrland	39 669 463·01	11 003 300·00	11 003 200·00	9 002 245·15	5 379
Örebro län	35 340 390·94	17 585 150·00	16 325 300·00	12 967 910·55	3 642
Total	**876 185 669·28**	**383 105 065·00**	**373 167 710·00**	**297 040 637·03**	**70 832**

the estate-owners the right to give notice after 10 years of repayment of loans on landed property advanced by the Societies.

In this connection, the net amount of the capital-discount (Disagio) was carried over in 1897 from the Bank to its Societies, while, at the same time, an amortization system was drawn up, whereby all the discounts were amortized by the close of 1912.

By taking this step, the loan business of the Mortgage Bank has adopted entirely the simpler and freer forms that, at an earlier date, marked the loan business of the Bank of Sweden.

The reform makes it possible to choose the most suitable time for converting loans, whereby land-owners are given the prospect of obtaining those loans at the low rates that the best mortgage society of the country should be able to ensure.

The Department of Agriculture is at present preparing a bill for the creation of loan-negotiation institutions for small farmers and small farms.

Those desirous of learning something more of the development of the Mortgage Bank are referred to the work "The Swedish General Mortgage Bank" (Sveriges allmänna hypoteksbank 1861—1911) which was issued in Swedish in 1911, to celebrate the 50th year of the Bank's existence; information can also be obtained from the Bank Directors' and Auditors' Reports, etc., which have been the source from which the principal part of this account of the work of the Banks been obtained.

Mortgage on Real Estate.

The official statistics of Sweden give annual reports of the amount of the total of mortgages granted and redeemed (or otherwise voided), and also give a calculation of the amount of indebtedness [1] still remaining, but, as no distinction is made between landed property and other real estate, we do not learn the amount of the debt resting on the land. Some idea may be gained in this respect, however, as the statistics in question make a distinction between country and town. At the close of the years 1880, 1890, 1900, and 1910—12, it was calculated that the entire amount of the mortgage-debts on real estate was as follows — the assessed value being given at the same time:

	Year	Assessed value kr.	Mortages kr.	In %
Country districts	1880	2 302 306 035	795 691 445	34·6
	1890	2 463 186 845	977 629 214	39·7
	1900	2 862 072 050	1 193 540 696	41·7
	1910	4 114 696 050	2 002 260 391	48·7
	1911	4 157 452 960	2 104 793 719	50·6
	1912	4 212 749 795	2 191 727 003	52·0
Towns	1880	732 478 366	329 893 782	45·0
	1890	1 150 514 171	641 662 615	55·8
	1900	1 639 620 830	962 240 628	58·7

[1] It should be noticed, however, that some of the mortgages are most probably in the possession of the owners themselves, and thus do not represent indebtedness in the ordinary sense of the word.

	Year	Assessed value Kr.	Mortages Kr.	In %
Towns	1910	3 021 732 260	1 925 176 101	63·7
	1911	3 141 544 396	2 009 829 102	63·9
	1912	3 213 512 223	2 095 917 823	65·2
The whole Kingdom	1880	3 034 784 401	1 125 585 227	37·1
	1890	3 613 701 016	1 619 291 829	44·8
	1900	4 501 692 880	2 155 781 324	47·9
	1910	7 136 428 310	3 927 436 492	55·0
	1911	7 298 997 356	4 114 622 821	56·3
	1912	7 426 262 018	4 287 644 826	57·7

During the last thirty years, therefore, both the assessed value of real estate as well as that of the mortgages resting on it, have steadily and continuously increased. This increase is specially noticeable during the last decade. In spite of the great increase in the assessed value, the proportion borne towards this value by the amount of the mortgage debts has, too, risen very considerably.

Among the various läns of Sweden, in 1912, the mortgage-percentage was highest in the City of Stockholm (71·4), Jämtland Län (72·2) and Malmöhus Län (64·1), while it was lowest in the Läns of Västerbotten (39·5) and Västernorrland (42·3).

Cf. also Mortgage Institutions.

Loans and Grants for Cultivation.

State grants, in the form of loans, are made from the so-called **Cultivation Loan Fund** for the reclaiming of boggy lands. The amount of the loan can amount to the calculated expense of — the subsoil draining excepted — ditching the land in question, but must not exceed 70 % of the estimated improved value of the land which is gained by means of the work in question. On making the grant, the condition is attached that all suitable land affected by the undertaking must be placed under cultivation. Since 1883, when the loan-fund was established, the loan-conditions have several times been altered to the advantage of the borrowers. According to the conditions now in force (dating from October 9, 1914), no interest is paid on the loan during the first three years. The interest is reckoned at the rate of 3·6 % per annum, and is added to the capital sum of the loan, after which, from the beginning of the seventh year, an annuity is to be paid of 6 % on the total capital thus obtained, of which 6 %, 3·6 % is reckoned as interest and the remainder as amortization. The annual payment has to be made when the Crown taxes are paid. The Cultivation Loan Fund is administered by the Exchequer, while the Government has the right to grant loans from the fund. The total amount of these loans, however, must not exceed 1 million kronor. During the last few years, grants have been made to an amount of 800 000—900 000 kronor annually. During the period 1884—1912, a total amount of 18 486 700 kronor was granted in cultivation-loans for the draining of 143 459 hectares of boggy land, representing 1 041 different enterprises, of which, during the period 1902—12, there was advanced a total sum of 8 864 770 kronor, for 62 883 hectares, representing 627 enterprises.

In addition to this, the Riksdag, for a number of years in succession, has made **grants,** free from the condition of repayment, to the amount of 300 000 —700 000 kronor annually, to aid such bog-draining and carrying-off of water, the aim of which is to diminish the liability to frost of the land in the neighbouring cultivated tracts. During the years 1884—1906, a total sum of

5 053 973 kronor was granted to 1 226 such undertakings, of which about 80 % was for the benefit of the three most northerly läns.

From and including 1907, this grant was divided into two; the **Norrland draining grant** and the **General grant for the diminution of frost.** From the former grant, help is given to reclaiming enterprises in Norrland and Dalarne, whether their aim be to gain land for arable or grazing purposes, or merely to to diminish the liability to frost. During the last few years, the grants have amounted to 700 000 kronor annually, but for 1912 they were increased to 800 000 kronor and for 1913 and 1914 to 1 100 000 kronor annually. For 1915 a grant of 1 900 000 kronor has been placed at the disposal of the authorities who have this matter in hand, to be employed for the same purposes. During the period 1907—12, the total of the first grant amounted to 4 110 830 kronor, for the draining of 84 611 hectares, representing 832 undertakings.

From the *general grant for the diminution of frost*, grants have been made for such enterprises in the other parts of the country the object of which is to diminish the danger of frost for the neighbouring cultivated tracts. During the years 1907—12, there have been granted 764 130 kronor for the draining of 12 887 hectares, representing 162 enterprises. These grants came to an end with the year 1912.

For the year 1912, the Riksdag made a further grant, the **General draining grant** of 300 000 kronor, an amount which, for the year 1913, was increased to 450 000 kronor. This grant is to be used for the benefit of other parts of the kingdom than Norrland and Dalarne, in accordance with the regulations and conditions laid down for the Norrland draining grants. Not more than 150 000 kronor of the amount, however, may be employed for the draining of such land, when the operation in question is only for the purpose of diminishing the tendency to frost. State contributions are made from the above-mentioned grants, the amount of each of which may amount to not more than one-half of the estimated cost of draining. In order to obtain a subvention from the general draining grant for 1913 the condition is also attached that, when the grant is to be employed for the draining of land suitable for arable- and meadow-land, the said grant may not be more than one-third of the estimated total cost. From this grant, during 1912, there has been advanced a total sum of 143 980 kronor for the draining of 1 537 hectares, representing 23 undertakings.

From the year 1907 inclusive, there has, in addition, been made available the **Norrland land-reclaiming fund** for the promotion of the reclamation of waste lands in Norrland and Dalarne. From this fund grants are made, as far as circumstances permit, to County Councils and Agricultural Societies there that have expressed their willingness to grant loans to small farmers who intend to bring suitable waste land under cultivation. The loan is free from interest the first year, after which interest at the rate of 3 % per annum is added to the capital advanced. Such loans made by the County Councils or Agricultural Societies may not exceed 500 kronor in each case, and on no account may they exceed one-half of the estimated expense of reclaiming the land. During the years 1911—15 the sum advanced from the fund amounted to 1 021 705 kronor, distributed over 2 894 loans. The area of the land reclaimed was 13 607 hectares, and the estimated total expense of the work 2 955 941 kronor.

In addition, the Riksdag has made a grant of 100 000 kronor, to begin with the year 1915 inclusive and to be known as the **General land-reclaiming fund,** which is to be employed for parts of the country other than Norrland and Dalarne. The conditions on which the loans are granted are the same as those for the fund just mentioned, though interest on the unpaid capital-amount is reckoned at 4 %.

From the year 1914 inclusive, the Riksdag has granted 200 000 kronor annually to the **Subsoil-draining loan fund,** for the purpose of advances to be made through the Agricultural Societies to the owners or cultivators of farms not exceeding 50 hectares in area. Loans are granted to an amount not exceeding 70 % of the estimated expense of the work, bear interest at 4 % per annum and are amortized in 10 years by the payment of 1/7 of the loan-sum during the last seven years of the amortizing period.

Provincial Agricultural Societies.

The first Provincial Agricultural Society in the present kingdom of Sweden was founded in the island of Gottland in the year 1800, but, previous to that date, the Finnish Society had been formed in 1797. Between 1803—12, Agricultural Societies were established in seven other läns, and after the foundation of the Academy of Agriculture in the year last-mentioned, and after the Societies had received a more official character by their statutes being confirmed by the Government, no long time elapsed before Agricultural Societies were in operation in almost every län of Sweden. As Kalmar and Älvsborg Läns have two each, the total number of such Societies is, at present, 26.

In accordance with the renewed general principles for the organization of the Agricultural Societies of the kingdom which were accepted by the Government in 1910, the object of the said Societies is the promotion of agriculture and its dependent industries, and also of the fisheries. The Societies have the right of electing their members themselves, to any number they may choose, as well as their chairmen and vice-chairmen. A special section of each Society, consisting of the chairman and vice-chairman, together with not less than five members, and called the managing committee, shall be entrusted with the management of the finances of the association; shall prepare all the current business before it is placed before the Society for decision; shall supply the authorities with the information they may ask for; and shall carry into effect the decisions of the Society. A yearly report shall be sent in to the Board of Agriculture respecting the condition of agriculture and its dependent industries, and respecting the condition of the fisheries, together with the changes which have taken place in these industries during the preceding year. With the exception of some few additional regulations, framed by the Government, the Societies are entitled to control and to draw up the statutes of their organization themselves — the statutes, however, must be submitted to the inspection and for the approval of the Government.

During the last few years, a number of the Agricultural Societies have introduced a system of delegateship, the delegates being entitled to act in the name of the Societies. As the number of members in most of the Societies has increased very largely, the introduction of such a system as the one mentioned is a necessity that can hardly be avoided, if the risks attendant on the decisions reached by irresponsible, accidental majorities are to be avoided.

The Agricultural Societies, which have greatly promoted the interests of agriculture and its dependent industries, had, at first, no other source of income than the fees received from the members. Very soon, however, the State began to assist certain branches of agricultural industry by means of grants and loans, with or without the obligation of repayment. The changes in the legislation respecting spirits, effected in 1855, provided the Societies with a liberal income, as, until the year 1885, they were granted one-fifth, and, after that date, one-tenth, of the resources obtained in their respective districts from the sale of spirits. In consequence of a regulation dated 1905, these resources were divided

in such a way that one-eight of all payments received within the whole of Sweden were shared between the Societies in proportion to the population of their respective districts. The Riksdag of 1913 fixed the amount of compensation to be paid to the Agricultural Societies instead of the receipts, which are now paid to the Public Treasury, at 2 100 000 kr. annually. The Riksdag of 1914 resolved that this amount should be divided between the Agricultural Societies during the years 1915—19, in such a way that a fixed sum of 10 000 kr. should be given to each Society and that, of the remainder of the grant, one half is to be awarded in proportion to the number of the population engaged in agriculture and fishing within the districts of the respective Societies. The other half of the said remainder is to be divided in proportion to the other part of the population in such districts, this with the reservation, however, that if, in consequence of the above division being carried out in accordance with these principles, any Agricultural Society should receive less than 35 000 kr., the difference shall first be given to the Society in question, and the remainder of the grant shall be divided, as mentioned above, among the other Societies. — From the year 1920 inclusive this plan will be so altered, that the amount which is to be divided according to population is to be allotted as follows: three-fifths shall be given in proportion to the number of persons engaged in agriculture and fisheries, and two-fifths in proportion to the rest of the population.

In consequence of the large State grant received by the Agricultural Societies in the form of spirit-sale revenue, they were able to extend their field of activity very extensively and powerfully to support agriculture. For a long succession

TABLE 31. *Revenue and Expenditure of the Agricultural Societies.*

	Annually 1882—1885	Annually 1886—1890	Annually 1891—1895	Annually 1896—1900	Annually 1901—1905	Annually 1906—1910	Year 1912
Revenue.							
Membership-fees . . .	13 654	15 139	18 274	21 741	27 527	36 808	45 377
Interests, rents	132 466	130 247	143 466	181 849	240 006	306 264	333 749
Share of spirit-sale rev.	804 386	750 170	900 352	1 148 013	1 512 167	1 786 389	2 382 306
State grants[1]	86 065	106 819	192 164	312 970	474 206	676 581	946 724
County Council grants	53 012	67 750	83 510	129 738	228 499	283 531	299 436
Other sources of income	98 281	110 312	94 311	89 962	36 824	90 532	169 102
Total	1 187 864	1 180 437	1 432 077	1 884 273	2 519 229	3 180 105	4 176 694
Expenditure.							
Farming in general . .	266 687	255 666	309 430	425 129	598 735	836 724	1 118 383
Horse-breeding	110 079	70 771	111 412	174 533	275 190	335 417	393 101
Cattle-breeding and dairy industry	103 381	139 119	264 168	336 967	402 474	520 720	621 543
Other Live stock-breeding	4 526	2 798	7 655	11 296	21 266	37 516	71 716
Veterinary service. . .	47 055	52 640	60 394	75 390	108 440	133 758	119 914
Gardening	59 287	48 366	48 587	65 222	87 903	100 078	114 880
Forestry; gamekeeping	76 162	73 767	83 281	116 935	144 456	68 647	69 796
Fisheries	43 544	30 006	33 582	47 872	73 271	96 978	118 368
Domestic sloyd	127 337	107 259	106 269	130 153	178 941	197 523	209 851
Meetings and exhibitions	109 519	68 036	62 393	80 516	92 285	88 328	101 457
Administration	142 802	139 170	151 410	178 834	243 958	316 164	425 489
Expenses involved by loans for the "own home" movement . .	—	—	—	—	[1]122 182	21 166	36 310
Other expenses	79 027	83 950	100 087	149 062	183 666	178 627	141 934
Total	1 169 406	1 071 548	1 338 668	1 791 909	2 432 767	2 931 646	3 542 652

[1] The figures are for 1905.

Spirit-sale revenue given to the Agricultural Societies:

Calendar year	Annually, kronor
1856—1860	183 143
1861—1865	240 520
1866—1869	247 224
Sale year	
1/10 1870—30/9 1875	364 334
1/10 1875—30/9 1880	860 224

of years nearly all the financial support received by agriculture was that bestowed by the Agricultural Societies, the State contributing very little by means of direct grants for this purpose. During the last few years, however, State grants for the promotion of agriculture have become more and more liberal, but these, too, have, on the whole, been distributed through the Agricultural Societies. For example, nowadays, the societies receive State grants towards premiums for agriculture, cattle, horses, and swine; for the fisheries administration and the promotion of fisheries; for arranging courses of instruction for small farmers, and journeys for the purpose of agricultural study; for pig-breeding associations and pig-breeding stations; for the support of seed-control offices, farm-agency- and agricultural book-keeping offices, and for the appointment of agricultural experts and ambulatory farming instructors. Since the beginning of 1913, the Societies have also received a State grant towards local investigations for agricultural statistics and preliminary reports for fishery-statistics. A number of Agricultural Societies receive grants from County Councils, too.

The revenue and expenditure of the Agricultural Societies since the beginning of the year 1882 — the earliest date from which there are full data — are shown by Table 31, and their share of the spirit-sale revenue received before that date by the Table in the text.

The largest income of any of the Agricultural Societies in 1911 was that of Malmöhus Län's Agricultural Society, amounting to 353 807 kronor; the least was that of Kalmar Län (north) 57 220 kronor.

The *accumulated capital* of the Agricultural Societies amounted to:

	Kr.
At the close of 1880	3 454 831
» » » » 1890	3 658 209
» » » » 1900	5 414 198
» » » » 1910	7 347 839
» » » » 1912	8 233 576

Inclusive of the funds for special purposes (formed by donations or otherwise), the total sum amounted in the last-named year to, 9 030 287 kronor.

As is shown by the Tables, both the amount received from the sale of spirits and that of the State grant have increased very considerably in the course of time, and the Agricultural Societies, consequently, have had gradually increasing sums to administer. It is undeniably a peculiar feature of Swedish self-government that such considerable sums of *public* money are administered by these private societies, which elect their members and appoint their governing bodies themselves.

A special task lying within the province of the Agricultural Societies is the procuring of preliminary data agricultural statistics. As was mentioned above, the Agricultural Societies nowadays receive a State grant towards covering the expenses of local investigations, which are so carried out that one-eight of each

TABLE 32. *Own Home Loans made by the State per the Agricultural Societies.*

Year	Farming Loans		Dwelling Loans		Total	
	Number	Kronor	Number	Kronor	Number	Kronor
1905 . . .	664	1 421 880	245	371 380	**909**	**1 793 260**
1906 . . .	441	1 032 989	196	337 702	**637**	**1 370 691**
1907 . . .	645	1 673 475	366	736 220	**1 011**	**2 409 695**
1908 . . .	900	2 473 235	446	888 830	**1 346**	**3 362 065**
1909 . . .	987	2 698 355	365	697 600	**1 352**	**3 395 955**
1910 . . .	1 236	3 552 060	346	660 325	**1 582**	**4 212 385**
1911 . . .	1 036	3 019 160	307	595 350	**1 343**	**3 614 510**
1912 . . .	1 113	3 019 534	359	692 050	**1 472**	**3 711 584**
Total	**7 022**	**18 890 688**	**2 630**	**4 979 457**	**9 652**	**23 870 145**

Society's district is examined every year. The investigations have to be carried out during the months of June—August by specially appointed persons, who, as a rule, must visit each independent farm, croft, or other holding, of at least 1 hectare in area. The information obtained at each place has to be entered on a special "question-card", the form of which has been drawn up by the Central Bureau of Statistics and the Board of Agriculture.

Another task voluntarily undertaken by the Agricultural Societies is the arrangement of the State *loans for promoting the "own homes" movement.* Although there are other societies, etc., too, that arrange such loans, it is the Agricultural Societies that have undertaken the greater part of the work, especially as regards the agricultural holdings.

According to the conditions and regulations for the State "own homes" loan movement, such loans may only be advanced for the purpose of creating such homes where the receiver of the loan owns both the land and the buildings erected on it; they can be granted for the acquisition of holdings intended for cultivation (Sw. jordbrukslägenhet), or of holdings where the dwelling house is the principal thing (Sw. bostadslägenhet). Such "own-home" loans may only be granted to anyone, man or woman, who is a Swedish subject, at least 21 years of age, of good character, known to be thrifty, sober, and well-behaved, and who, although, it is true, is not in want of means to contribute in some degree towards the acquiring of an "own home" needs effective assistance to be able to acquire it.

"Own home" loans for farming-holdings shall amount to not less than $^1/_2$, and not more than $^5/_6$, of the estimated value of the holding; in the case of a dwelling-house holding, the corresponding figures are $^1/_2$ and $^3/_4$ respectively. "Own home" loans may not be granted in those cases when the estimated value of the holding exceeds 7 000 kronor for a farming-holding provided with necessary houses, 8 000 kronor for a farming-holding without houses and 4 000 kronor for a dwelling-holding. (Estimated value includes value of land and buildings existing there on or which are intended to be erected there.)

The loan is divided into two equal parts, an amortization-loan and a standing loan. An annual payment of 6 % has to be made on the amortized part of the loan on a farming-holding, and one of 7 % on a dwelling-holding loan. Of this amount, the interest is calculated as coming to 3·6 %, the remainder being the instalment due each year. Interest at 3·6 % is paid on the standing loan.

As the obligation to pay the amortization sum does not commence before the

fourth year after the close of that calendar year during which the loan was granted, a period of about 29 years elapses before the final payment of the amortization loan on a farming-holding, and about 24 years for the payment of that on a dwelling-holding.

As long as the receiver of the loan fulfils the obligations imposed on him by the conditions of the loan-agreement, the body that has granted the loan cannot give notice for repayment until the amortization part of the loan has been fully paid off. The State "Own Home" loan movement, per the Agricultural Societies (cf. "Own Home" Movement), which began in 1905, may be seen by Table 32.

Chemical Analysis Offices.

The object of these offices is to promote the development of farming and other industries by giving advice and information, more especially by means of analyses of farm produce, technical products, and the like. The first public offices of this kind were established in 1876, at Skara, Halmstad, Kalmar and Västerås. In 1881, one office was started at Örebro, in 1885 two, viz., at Jönköping and Härnösand, in 1895 one at Luleå, and, finally, one in 1900 at Visby. To each of these nine *State offices* for chemical analysis the State gives an annual grant of 6 000 kronor (exceptionally, however, to the office at Luleå, which is also an experimental station, 11 250 kronor); they enjoy support besides from the Provincial Agricultural Societies or the County Councils, varying from 2 500 to 7 500 kronor. There is, in addition, the income from fees for analyses, which varies from 1 200 to 6 900 kronor. At every station there is a director and one or two, or sometimes more, assistants. All these offices are connected with *Seed-control offices* which, with one exception, are under the management of one and the same director. — Regulations for the work of these State Chemical Analysis Offices were issued for the first time in 1877; those at present in force respecting the carrying out of tests date from June 15, 1906.

Certain *Agricultural Societies* and *County Councils* have also by degrees established separate chemical laboratories and control-offices for public analysis within their own districts, with a view to giving the farmers in their respective läns an opportunity to get analyses made at a lower cost. The oldest of these is at Alnarp and was opened as early as 1866. These establishments are either connected with State institutions, as is the case with the chemical offices of the State Agricultural High Schools at Alnarp and Ultuna, or with technical schools, with the bureau of the City chemist, etc., as at Norrköping, Gävle, Hälsingborg, Gothenburg, Borås, and Kristianstad. These eight offices have State grants varying from 1 000 to 3 000 kronor. Some of them have also a department for *seed-control*. The milk-control establishments previously existing, which were kept up at the expense of the Agricultural Societies, on the other hand, ceased to exist during the first few years of the present century, this being the result of control-associations now carrying out the milk-tests in question. Some of the chemical analysis offices, however, carry out a large number of milk-testings every year; at Visby, for example, some 50 000 are made annually.

In 1912 there were as many as 120 000 analyses made at the State chemica offices, and, at the offices of the Agricultural Societies, 36 500.

Some of the chemical offices are, at the same time, experimental establishments, where experiments of various kinds are carried out. This is the case with the offices at Kalmar, Jönköping, Skara, Örebro, and Alnarp, and also with that at Luleå, which should rightly be considered as an experimental establishment.

The State grant to these 17 analysis offices amounted in 1912 to 60 000 kronor, and the combined grants from the Agricultural Societies and the County Councils to 56 000 kronor.

The director of each of these offices issues an annual report, and the Board of Agriculture afterwards publishes a summary of all these reports.

Agricultural Experimental Institutions.

As in other countries, agricultural experiments in Sweden were, at first, closely connected with the work of control. The earliest experimental work, both at the Academy of Agriculture and at the Agricultural High Schools, was of this kind, and, to a certain degree, is so still, as a number of chemical stations carry on their researches side by side with their proper tasks of giving advice and information to farmers and others, and of inspecting agricultural products and other necessities of life.

Photo. HERTZBERG, Stockholm.

Central Establishment for Agricultural Experiments at the Experimentalfältet, Stockholm.

Most of the experiments in agriculture are made in connection with the **Central Establishments for Agricultural Experiments,** founded in 1906, which is a development of the work that has long been carried on at the Experimental Grounds of the Academy of Agriculture. The task of this State institution is to carry out systematic experiments and scientific investigations in various parts of the country for the purpose of benefiting agriculture, while it is also to place itself in communication with other experimental Establishments that work for the improvement of agriculture.

The Central Establishments embraces six divisions. The division for *Agriculture* has been for the most part engaged in local experiments made in the different country districts. These experiments, which had already been begun in Sweden by certain of the Agricultural Societies as early as the close of the last century, and which were intended to discover the most suitable manures for the soil in various places, and also to carry out of trials with certain sorts of seed, have been more or less intimately included under this division. In addition to this, experiments have been carried out at the Experimentalfältet just outside Stockholm, and on other farms in the country, in connection with the preparation of the soil, manuring, the cultivation of plants, etc. In the division for *Agricultural Chemistry* the chief experiments have been those made in pots, for the purpose of discovering the relative effects and values of different manures. The division for *Cattle-breeding* has, by means of experiments on large farms, determined the values of many of our different kinds of cattle-foods; in close connection with this stand the *Dairy experiments* intended to solve problems connected with the Swedish dairy trade. A separate division has lately been created by the separation, from the last-mentioned division of the *Bacteriological* department, for the study of the microflora of the soil, manures, and milk. In addition, there is a division for *Agricultural Botany*, which is chiefly directed to the study of the diseases of cultivated plants and of the methods of combating these diseases, while, finally, there is the *Entomological* division, which carries out investigations respecting the insects and animals injurious to agriculture, and the protective measures to be adopted against them.

The management of the various divisions is entrusted to 6 professors and 2 chief assistants, who are stationed at the above-mentioned Experimentalfältet near Stockholm, where the institutes and the dwellings of the staffs are situated. During the last few years, the annual cost of this experimental work amounted in round numbers to 140 000 kronor. An account of the work done and the results obtained is given in a series of "Meddelanden", which, during the year 1913, amounted to no less than 88; in addition to these, there have been published 40 fly-sheets, containing notices of smaller scope.

As before mentioned, there are carried out local experiments, arranged by the Agricultural Societies, besides experiments with certain sorts of seeds of cultivated plants, made by the direction of the Swedish Seed Association. To some extent, these co-operate with the work done by the Agricultural Societies described above. Quite independent, however, is the work carried out by the Swedish Moor-Culture Association, the Phyto-Biological Establishment at Luleå — the latter for the purpose of solving problems connected with cultivation and manures in Upper Norrland — and the two Agricultural High Schools at Alnarp and Ultuna.

Seed Control Offices.

The first establishment for the testing of grain and seed was opened in 1869, at Tharandt (Saxony) by Professor Nobbe; a few years later, in 1876, seed control was introduced into Sweden by *Aug. Lyttkens*, at Nydala in Halland Län. Seed control in Sweden can, therefore, now look back on 38 years of work; work which has been of importance for the agriculture of the country in more respects than one. At present there are 17 seed control offices in Sweden supported by public means. At first the seed control offices were maintained by the agricultural societies alone; since 1887, however, the Riksdag has placed at the disposal of the Government every year a sum of 10 000 kronor, to be employed for the support of those seed control offices which receive grants from agricultural societies or County Councils of at least the same amount as those given by the State, and which agree to be governed the regulations laid down by

the Government. The instructions now in force for seed control offices, supported by public means are issued by the Board of Agriculture and date from the 10 June, 1914; they are accompanied by special rules for seed control examinations. These instructions, when suitable, have been adopted in Denmark and Norway too. The total number of analyses carried out at the Swedish seed control offices amounted during the working season $^{1}/_{7}$ 1913—$^{30}/_{6}$ 1914 to 17 100, while 5 708 482 kilograms of seeds, or 67 602 sacks were officially sealed. During the year 1913 there was received from public means, in addition to the above-mentioned 10 000 kronor from the State, a sum of 16 610 kronor from various bodies in the different läns.

Sowing Seed Question.

At the close of the "seventies" there began a new period for plant cultivation in Swedish agriculture. The extensive export of grain, which, during the few previous decades, had formed the chief source of income for the farmers, began gradually to decline in consequence of the pressure caused by the increasing supplies of cheaper grain sent to the European markets from trans-oceanic countries. The immediate result of this was that far greater attention was paid to cattle-breeding and dairy farming, but there also arose an endeavour to utilize the advantages — much spoken of at the time — of a northern climate for the production of good sowing-seed, to create a fresh branch of export — that of grain and seed for sowing purposes in more southern countries. This question was discussed with the greatest eagerness at special seed congresses and exhibitions; local seed-cultivation and sowing-seed associations were formed, and sample shipments were made to most of the countries of Europe.

The result of this experiment was, however, quite different from what had been expected, and it became evident that it was necessary first to procure better and more prolific varieties before there could be any possibility of taking up the struggle on the seed markets of the continent. It was to solve this problem that the Svalöv Association was formed, which then became the body that — more than any other institution in the country — brought the sowing-seed question to a position which nobody could have anticipated at the beginning.

Gradually, however, new conditions arose, which once more called for fresh efforts in the sowing-seed question, and led to the formation of new seed cultivation associations, whose field of operations was a more restricted one. In consequence of an increasing import of red clover seed, of the ordinary, greatly varying qualities found in the world's markets, and which were seldom suitable for the climatic conditions over the greater part of Sweden, a general sense of insecurity had gradually grown up with regard to the Swedish trade in this kind of seed, and, as a result, in the whole department of the grass cultivation of the country. The situation, aggravated by the failure of the clover-seed harvest in 1902, became a most threatening one; a movement was aroused in farming circles which soon led to the adoption of energetic measures for the preservation of the valuable resources possessed by Sweden in its native late clover, and to secure an increased supply of seed of this kind.

As the result of an investigation made by the Board of Agriculture, a State grant has been annually made since 1907, amounting at first to 15 000 kronor, but at present to 20 000 kronor, to the agricultural societies which had taken steps in the direction mentioned above, especially by the organization of seed cultivation associations, which could take the matter in hand direct. As a result, 15 such associations have sprung into existence in various parts of the country, which now endeavour in various ways to promote the production and spread of

pure and good seed — of grass seed in the first place, but also of that of root crops. By an ordinance issued in 1909, requiring all imported clover seed to be coloured, a sure method has also been got for preventing the spread of less hardy sorts of seed in such parts of the country for which they are not suitable.

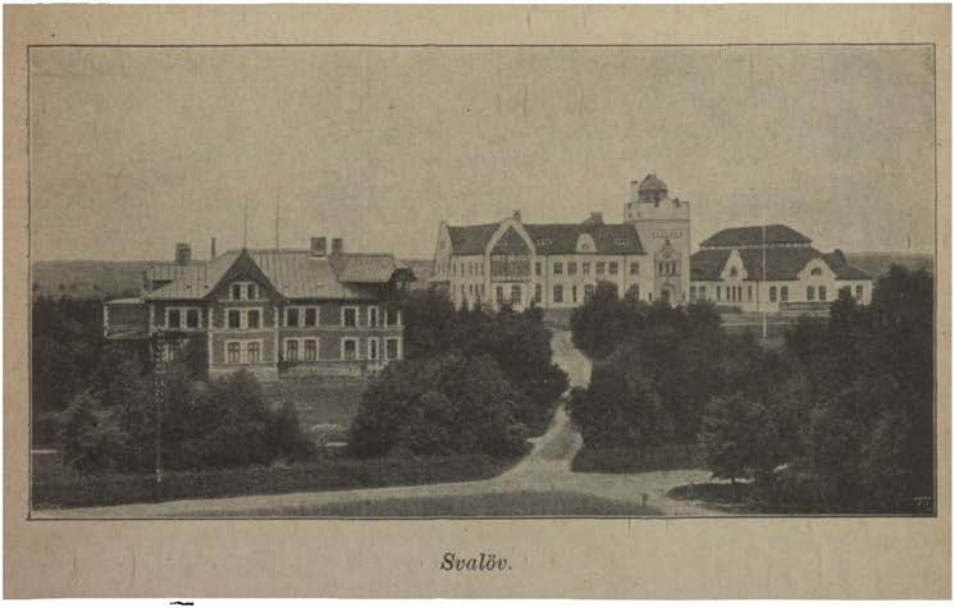
The work done at Svalöv through the efforts of the Swedish Seed Association and the General Swedish Seed Co., Ltd. The rise of this work in connection with the seed-culture question has already been mentioned. Like so many other enterprizes of public importance in Sweden, it rose from private initiative among the ranks of the farmers themselves, and from the demand a more thorough system of agriculture gave rise to for a better quality of seed than that hitherto found in old, native sorts, or in the unreliable seed from abroad. In 1886 there was established for this purpose a local association, whose chief office was at Svalöv in Skåne, but this society was developed the very next year to a general Swedish one, and, finally, after its fusion in 1894 with an association which had been founded for the central parts of the country after the rise of that of Svalöv, it became the *Swedish Seed Association* (Sveriges utsädesförening), and, as such, represents the work performed in common in aid of this branch of agriculture. All the agricultural societies came with their support and financial assistance (ca. 15 000 kronor annually, on an average) during the course of the first few years, and from 1890 the State gave a grant, amounting then to 15 000 kronor, but increased in 1905 to 40 000 kronor, in 1913 to 50 000 kronor, and in 1914 to 81 000 kronor, after the agricultural societies had withdrawn. The number of members is 1 300, of whom 300 are life-members, the remainder paying an annual subscription of 5 kronor. The budget for 1913 amounts to more than 100 000 kronor, one of the items being 60 000 kronor received in payment for the Association's seed offered for sale. The fees of 100 kronor each paid by the life-members, which amount to 35 000 kronor, have been made over to the building fund, which has also received gifts amounting to more than 265 000 kronor, a speaking testimony to the interest felt by the public in this matter. The Association now owns a magnificent, specially equipped establishment at Svalöv, with an estate in connection with it.

The work of the Association is carried out chiefly at Svalöv, although, in order that the various parts of the country may profit by the results obtained, two branch establishments have been opened, one for central Sweden at Ultuna, which has been in operation since 1897 (from 1894 at Örebro), and one for Norrland, at Luleå, since 1906. The work is superintended by a director (since 1890, Professor N. Hj. Nilsson) and twelve permanent officials, 5 of whom are specialists at Svalöv. Each branch-office has also a director.

The Association has pursued its task of improving plant cultivation in Swedish agriculture, principally by the breeding of new and richly productive varieties of the various kinds of seed which are specially adapted for the varying conditions in the different parts of the country. The first to be taken in hand were wheat, barley, oats, peas and vetches, after which there gradually came rye, potatoes, clover, grass, and root crops. The new varieties obtained have, after being thoroughly tested, gradually come into very general use all over the country; in certain parts of Sweden they have practically entirely superseded the older sorts and are coming into more general use in the more northerly parts of the country, too. It is acknowledged very generally, too, that they have essentially contributed to the considerable increase in value exhibited of late years by the harvests in Sweden. Abroad, too, they have attracted great attention and are being much employed, and have made the name of Svalöv known over the whole of the civilized world, which is proved,

among other things, by the many visitors from distant parts of the globe who inspect the establishment every year.

This success, which was somewhat unexpected in a land lying so far to the north and so little favoured by climate, is explained in the first place by the fact that it is really the first time that an establishment, fully equipped with scientific resources, has been *exclusively* employed for the purpose of improving cultivated agricultural plants. The independence enjoyed by the establishment, its direct connection with practical farming and farmers, and the consequent practical arrangement of the place, have clearly contributed to its success as well.



Svalöv.

Respecting the method of work adopted at Svalöv — an account of which can be had from the publications issued by the Association — no more need be said than that the fundamental principle is simply applied botany, and that it has adopted the laws for the creation of forms and heredity, the existence of which has been proved by the scientific researches of the last few years. The discovery of valuable forms, wherever they are to be found, but above all in native material, and the cross-breeding of these again, therefore, form the chief feature of the method employed.

The work of the Svalöv establishment is supported, however, by another institution, too, the *General Swedish Seed Co. Ltd* (Allmänna svenska utsädesaktiebolaget), which began its operations in 1891. The Company has undertaken the practical utilization of the results obtained by the more scientific labours of the Association, and, consequently, it has the charge of the increase, maintenance, and sale of the new varieties of seed, on their appearance. All this is carried out under the direct and thorough control of the Association, as regards the cultivation of the new varieties in fields in various parts of the country — at present amounting to about 8 000 hectares — and the treatment of the harvested seed in the magazines, until it is sent in officially sealed sacks to the purchasers. This very effective arrangement has, very naturally, also contributed to the success of the Svalöv seed varieties all over the world. In other respects, the Company is entirely independent of the Association, having

its own organization and board of directors, its own economy, a large estate (nearly 600 hectares) in the immediate neighbourhood of that owned by the Association, a large store-house at Svalöv, and two branch offices at Norrköping and Gothenburg. Its capital amounts at present to 900 000 kronor.

The co-operation between these two enterprizes has, since 1909, been regulated by the Government, and the Riksdag, partly by their appointment of a representative of the Crown among the board and auditors of the Company and also by the limitation of the Company's dividends, and by the fixing of a certain payment for the new varieties received from the Association, etc. As the labours of the Company, too, have lately been vastly increased, the combined Svalöv organization has thereby gained greatly in internal strength, as well as in importance for the agriculture of the country.

The interest with which the work of the Swedish Seed Association has been received has also encouraged private growers to try in the same way to produce new varieties of Swedish cultivated plants. The leading position among these private growers is occupied by *Messrs Weibull*. On their estate, situated near to Landskrona, this firm have — at their own expense and without relying on any public grant — founded a seed-cultivation establishment, where splendid work is being done, entirely upon scientific principles. Especially deserving of recognition is the work being done for the production of new varieties of roots.

The Swedish Moor Culture Association.

This association was founded in 1886, on the initiative of *Carl von Feilitzen*, director of the Jönköping chemical station.

The purpose of the Association is to further the utilization of the extensive moors of the country, and, by lectures, publications, meetings, and other suitable means, to spread a knowledge of the best method of cultivating moors, bogs, and marshes, of the employment of peat as a means of improving soil and as litter, fuel and for technical purposes, and, finally, to employ its financial resources in aid of experiments for the promotion of moor-cultivation.

As the estimated area of bogland in Sweden amounts, in round numbers, to 5·2 million hectares, or about 12·6 % of the whole area of the country, the importance of the association and the extent of its field of work will at once be seen.

The Association possesses its own Institute at *Jönköping*, with a chemical and botanical laboratory, working premises for its various officials, and a special museum with extensive collections illustrating moor-cultivation and the different ways of employing peat.

Close to this building there is an experimental garden, where very exact experiments are carried out, partly in sunken vessels of cement protected by nets, and partly in pots, which can be wheeled on frames into a green-house whenever necessary, as a protection against unfavourable weather.

The Association also has two experimental farms for field experiments on a larger scale; one is at *Flahult*, 2 kilometers from Norrahammar station on the Jönköping—Vaggeryd railway, with an area of 108·8 hectares, 37 hectares of which are at present under cultivation, and the other at *Torestorp*, 4 kilometers from Bratteborg station on the same railway, with an area of 10·2 hectares. The Association has also started two "moor-settlements" or "own homes" at Flahult, and three at Torestorp. The Association also carries out agricultural experiments every year for moor-cultivators on small fields in most of the läns of Sweden, the total number of such fields in 1911 amounting to 51 in 20

different läns. Some of them are exclusively experimental fields, others serve as so-called model-fields for demonstrations to farmers.

The work of the Association can be divided into, firstly, *practical scientific* work, aiming at increasing the knowledge of peat soil, its distribution and various characteristics and qualities, and of the extent to which it can be employed, together with the proper method of treating it for various purposes: secondly, *advisory work*, by means of which the experience gained by the association is communicated direct to the owners of the moors, and, thirdly, the *work of spreading information*, in one way or another, respecting the experiments and observations made.

Besides the director and working chief, the staff consists of: 2 botanists and peat-geologists, 2 chemists, 1 assistant for greenhouse-experiments, 3 culture-engineers, each with his own district, 1 cashier, 1 typewriter, 1 inspector at Flahult and 1 foreman at Torestorp.

Peat-bog (uncultivated) at Flahult.

Field-surveys are carried out by the botanist each year in a different län, in order to obtain a more exact knowledge of the character of the peat-lands. Up to date (1914), 23 läns of the 24 in the kingdom have been thus submitted to a preliminary investigation.

In the chemical laboratory, examinations are made — at a very low fee — of the chemical quality of the peat, and the extent to which it can be used, and in the botanical laboratory there are determined the plant-constituents of the peat, partly by means of the microscope.

The consulting-work of the culture-engineers among the farmers is very extensive. In 1913, some 504 farmers were visited on 275 days, and 628 peat-bogs were examined, with a total area of 16 701 hectares. Consultative work has

been carried out free of cost to small farmers, formerly in two läns every year, and now in three läns, for a period of 20 days each year.

Finally, as regards the work of supplying information, the Association, issues a publication appearing 6 times a year, with a total of about 500 pages, and containing an account of the work done, the results obtained from the experiments, and the experience gained both at home and abroad in the field of moor-cultivation and the peat industry.

Experimental Garden of the Swedish Moor Culture Association, Jönköping.

Pamphlets, too, are frequently printed and distributed on a very large scale, in addition to which the officials of the Association publish a number of articles in the daily press and in Swedish and foreign agricultural and technical journals. Two ordinary meetings are held every year, one of them in some district with an abundance of moors, where practical, illustrative work is carried out, excursions are made, and lectures are given. Up to the close of 1913 the Association has had summer metings at 23 different places within 21 läns. The autumn meetings at Jönköping — at which lectures are given — are usually held in connection with some exhibition.

Besides this, the Association often takes part in exhibitions of greater or lesser importance, and this has proved to be a very effective way of spreading information on the subject of peat-cultivation.

Lecturing tours are made every winter by the culture-engineers of the Association, who, yearly, have to visit 3 different läns, and to give at least 10

popular lectures at various places in each län, the publications of the Association being distributed on each occasion; all this at the expense of the society. A number of lectures are also given at the meetings of the Association, at the courses in agriculture given for small farmers, etc. In 1913, for example, 127 lectures were given in 12 various läns by the officials of the Association. Since the year 1906, the Association has given a course of instruction in moor-cultivation for small farmers and moor cultivators, with lectures, demonstrations, and excursions. These courses have been very well attended, the average attendance on each occasion being about 300 persons. Finally it may be mentioned that the Association pays the expenses attendant on the lectures given every year by the director and the botanist at the State Agricultural High School, and that lectures on the work done by the Association have also been given at meetings of societies and at congresses abroad — in Norway, Denmark, Germany, Austria, England, and the United States.

The Association has devised and presented to higher and lower schools of agriculture object-lesson material, for purposes of instruction. The Association numbers at present some 2 100 members.

The Moor Culture Association enjoys a State grant in aid of its work, which, in 1914, amounted to about 50 000 kronor, in addition to which the Agricultural Societies and County Councils contributed about 11 000 kronor.

Farmers' Societies.

During the last few decades the various farmers' societies have powerfully contributed to the promotion of the development of agriculture and the increased interest exhibited by farmers in their common affairs. These farmers' societies endeavour, by means of lectures and discussions, to spread a knowledge of new ideas or methods of work, and to bring about an exchange of thoughts and opinions on these matters, and also, by means of economic associations, to facilitate and support agricultural production, either by the securing of cheaper or improved means of production, or by providing more favourable opportunities of disposing of agricultural produce. In connection with the endeavours made during the last few years to increase the number of small farmers in Sweden and to promote their economic prosperity, there have arisen in various parts of the country a number of "*own homes*" *associations*, some of which have assumed the form of limited companies.

To the first-named group of farmers' associations belong a large number of *agricultural clubs*, *farmers'*- and *small farmers' societies*, in various parts of the country. Many of the sub-divisions of the above-mentioned Provincial Agricultural Societies, the "*hushållsgillen* or *hushållningskontrakt*" as they are called, as well as several associations for the promotion of gardening, fishery, and forestry, work in a similar way, and the same can be said of the *Swedish Farmers' Association* (Svenska lantmannaförbundet), the members of which are spread over the whole of the country.

Of a more purely economic nature are the associations that have as their aim the improvement of agricultural products; such are, the *breeding-associations* for the various kinds of domestic animals, the *cow-testing associations*, the *milk-testing-*, *seedculture-*, *moss-litter-* and *book-keeping associations*, etc. Among these, the breeding-associations especially — the stallion-, bull- and boar-pig associations and the cow-testing associations — have spread enormously throughout the country. Those last mentioned, the aim of which is to acquire an exact knowledge of the fodder-consumption and the milk-returns of the individual cows, amounted in 1914 to more than 750, and have made it possible to carry out a systematized calculation of the milk-returns in cattle breeding.

For the purpose of improving and increasing the sale of farming produce, there have sprung into existence a large number of *co-operative dairies*, *egg-selling associations*, *starch factories*, and *distilling associations*, in addition to which, during the last few years, there have arisen *co-operative slaughter-house-* and *fruit-selling associations*, etc. The *Skånska smörexportföreningen* (the Skåne butter export association) works direct for export, and about one-third of the total amount of butter exported from Sweden passes through its hands.

A considerable number of *purchase associations* have been formed for the purpose of the purchase in common of fodder, manure, and other farming necessaries. First among these associations is the *Svenska lantmännens riksförbund* (the Swedish Farmers' National Association), which was founded in 1905 and has a number of sub-divisions in various parts of the country; the *central* associations, in their turn, divide the goods purchased among the local associations in the country districts. Last year (1913) purchases were made to a value of almost 8 000 000 kronor.

In addition to the above-mentioned associations, there also exist a number of smaller societies, which have already been mentioned elsewhere in this work, such as, the *Sveriges utsädesförening* (the Swedish Seed Association), *Svenska mosskulturföreningen* (the Swedish Moor Culture Association), *Avelsföreningarna för svensk ayrshireras och rödbrokig svensk boskap* (the Swedish Ayrshire and Red-and-White Swedish Cattle-breeding Associations), *Svenska svinavelsföreningen* (the Swedish Pig-breeding Association), *Sveriges allmänna fjäderfäavelsförening* (the Swedish General Poultry-breeding Association), etc., with members in various parts of the country. Since 1911 the greater number of the more important farmers' societies have had their annual meeting during the *Agricultural Week* held in Stockholm every March, which thus brings together yearly the most prominent members of the societies in question and, by means of discussions and lectures, gives opportunities for the spread of information on matters of actual, common interest.

Agricultural Meetings.

After the Provincial Agricultural Societies, in the forties, had begun a revived activity to awaken an interest in the promotion of agriculture, meetings were arranged in various parts of the country, where various discussions took place, and good breeds of cattle and new agricultural machines and implements were exhibited. The first general agricultural meeting for the whole country was held in Stockholm in 1846. Since that date, *General Swedish Agricultural Meetings* have been very frequent, taking place, at first, every second, then every third, and, finally, and at present, every fifth year. Money-prizes were awarded for the first time at the meeting in 1850. At the twenty-first meeting, that held at Örebro in 1911, there were entered, among other animals, 534 horses, 625 head of cattle, and 1 682 products of agriculture and implements used in agriculture and by-industries, together with 531 agricultural machines and implements. At the meeting, a sum of 79 094 kronor was awarded in prizes, while the expenses came to 330 000 kronor, of which the State contributed 105 000 kronor. Gradually the discussions held at these meetings have attracted less and less attention, and the chief aim of the gatherings is the exhibition of cattle, machinery etc. The rules for these meetings were approved at the meeting at Norrköping in 1906, afterwards receiving the sanction of the Government. — At certain intervals of time, meetings and exhibitions are held in the various *Läns*, too, and meetings on a smaller scale are also organized by the sub-divisions of the Agricultural Societies. Of late years there have been held

special exhibitions of dairy-products, poultry, seed, etc. As a rule, these meetings have been arranged by one or several Agricultural Societies, but rarely for the country as a whole.

Agricultural Bookkeeping.

Until the year 1911, the work of promoting the proper keeping of books by farmers consisted chiefly of the instruction in the subject given at the Agricultural Schools, both higher and lower. Certain Agricultural Societies — that of Malmöhus Län, for example — by arranging prize competitions, have endeavoured to obtain bookkeeping formularies suitable for farmers, especially small ones. Bookkeeping by the pioneers among these farmers has, too, been not a little promoted by the regulation appended to the rules for small-farming prize-competitions, that farms which are entered for these prizes must exhibit books kept in accordance with the forms approved of by the Board of Agriculture.

In spite of the educational work that has been carried on in this branch, bookkeeping has made but little headway in practical agriculture, as regards the small or middle-sized farms, at least, and it is only during the last few years that greater interest in the matter has been noticeable. The work of the cow-testing societies has certainly led to a considerably increased understanding of the value of detailed control in the rural husbandry, but it was the clause in the fiscal legislation of 1910, that taxes should be paid on the net returns of farms instead of, as was previously the case, on their assessed value, that created an increased necessity for, and interest in, the proper keeping of farm books.

Among the steps taken to meet this necessity, there have been instituted in several läns "Bookkeeping Bureaus", founded partly by the Agricultural Societies and partly by special Bookkeeping Societies. The first Bookkeeping Society was founded on the initiative of *L. Nanneson* in the neighbourhood of the People's High School of Vilan, in Skåne, in 1908. In 1911 this Society was merged in the *Malmöhus Län's Agricultural Bookkeeping Society*. Similar bookkeeping-bureaus have been planned or are being established in a large number of other läns.

The work carried on by the Bookkeeping Society is supported by a State grant of 15 kronor yearly for those members the area of whose farms does not exceed 75 hectares (185 acres), on the condition that a similar grant is made by the respective Agricultural Societies. The membership of these Bookkeeping Societies at the beginning of 1913 was: in that of Malmöhus Län, c:a 110 members, owning a total area of 6 000 hectares, Stockholm—Uppsala Län, 20 farms of a total of 2 700 hectares, the Sörmland Farmers' Bookkeeping Society, 45 farms; that of the Kronoberg Län ca. 25 members, and so on. These bookkeeping-bureaus have before them a great field of labour in the service of economic agriculture, and it is to be hoped that their endeavours will greatly promote the hitherto all-too-much neglected bookkeeping of the Swedish farming industry.

5. AGRICULTURAL LEGISLATION.

The origin of the Agricultural Legislation still in force in Sweden may be traced back to the Middle Ages. All the land in Sweden was not, however, equally affected by such enactments, for the lands called by the common name of fee-farms (Sw. frälse) which had come to be exempted

from certain taxes, and which, up to April 6, 1810, could only be owned by the Nobility (not taking here the Church as landowner into consideration), were but to a very small extent affected by them. It was other private tax-lands and also Crown farms that this legislation, collected in the Building Law of the Code of 1734, especially concerned. As long ago, however, as 1789, by a decree of Gustavus III, issued on February 21 of that year, it was declared that "all tax-paying landowners (Sw. skattemän), have the same rights over their farms, both the infield and outfield land, which have been fixed by legal surveys and boundaries, with woods and fields and fishing, shooting and trapping appertaining thereto, as unalterably and with as free right of disposal as the Nobility over their fee-farms", and herewith a great part of the agricultural legislation, which till then had been in force with regard to that land, ceased to be applicable to it.

The ordinance regulating the manner in which a village shall be established is very ancient; it may be said still to remain in force, as far as it can be applicable. The site for the village was first to be settled; greater shares in the village entitled to larger building plots; and the plots should be arranged east and west, north and south. In distributing the village land it was not the position of the plots that decided matters, but everyone had to get a share in the better land as well as in the worse. Plots had to be provided with farmhouses and barns and some other buildings that were enumerated as necessary, but, in other respects, everyone was allowed to build more and larger houses if he so needed. Roads and ditches for drainage were to be taken from undistributed land; and if any one wished to fence round his private land, within the limits of the village, he was at liberty to do so, provided only that others did not suffer damage from it. Where one village met another, the obligation of fencing was, else, to be shared between them. The land which a peasant thus occupied, he was to carefully till and manure; he should clear and keep the meadows in condition, and he should bring other land under cultivation, as far as he could do so without harm to forests or pasture-land — all under penalty of fines for neglecting these duties. Forests and pasture-lands were, in general, common to all the villagers, who might use them as much as they needed for grazing, firewood, or timber, turf, or other things, but not for purposes of sale, nor for use outside the limits of the village.

Amongst other details contained in the Building Law, which have now for the most part lost their importance, we must not, however, omit to speak of the enactments about burning woodland (Sw. svedjande), which are interesting, not only from a juridical point of view, but also from that of cultural history. In the extensive tracts of country where the inhabitants were still few and the supply of forest-land ample, the peasants were wont, without regard to the future, to "singe", or burn, the woodland, that is, to allow fire to pass over a tract of forest, so as to be able afterwards to sow rye in the ashes for two or three years in succession. As, however, such a burning of woodland rendered the tract of forest for a very long time unproductive, both with regard to the regrowth of the timber and partly also as regarded pasturage, it was decreed that, for such burning of woodland, permission must be asked both of the co-proprietors in the village and of certain public authorities.

As it was sought, in this and other ways, to fix by law the duties of the peasant, it was necessary, too, to arrange for some control to ensure the observance of the ordinances. This was to be obtained by inspection, a charge to be

exercised by a police officer and two jurats (nämndemän). On Crown farms, an inspection should be held every third year; on tax-land (see above), "when neglect or faulty building thereon was noticed" (till February 21, 1789). Everything should then be investigated; the buildings, within and without, fences and ditches, homefarm and forests — and what was then found wanting should be made good, and, possibly, even a fine be paid for it.

The agricultural legislation which has been enacted since 1734, and which ought to be considered in connection with this subject, is scanty enough. It is, in fact, contained almost entirely in the Royal Decrees of December 21, 1857, concerning the duty of fencing property, and of June 20, 1879, concerning draining etc. In the *decree concerning fencing*, the principle was laid down that everyone is bound to see that his cattle do no damage. The principle in regard to the duty of fencing also requires that, when fencing is to be done between the lands of two neighbours, the two shall share the expense, etc. equally. Only those, however, have a right, with inconsiderable exceptions, to insist on their neighbours' participation in fencing, whose forests or outfield land adjoin infield land, or whose land adjoins land of similar character. The fence which is thus put up shall be kept in the condition in which it is first constructed, and shall, in general, be kept in the condition required by law, from May 15 till frost has entered into the soil.

Conditions with regard to *draining* and the possibilities of reclaiming boggy land, have received a more modern form of expression by the ordinance of 1879. In the Code of 1734 it was merely prescribed that the villagers should, each according to his share in the village, keep his ditches in order; and that each one should, if necessary for his field, dig 40 fathoms of ditches or clear out 80 fathoms of old ditches. It was also prescribed that, if the ditches of one village met those of another, each village should dig through its own ground, and that, if anyone in digging ditches through his ground or meadow-land came to the meadow-land, pasture-land, or other outfield land of an other village, the said village might not prevent the outflow of the water. If a ditch happened to be necessary to furnish an outlet, and if the neighbours could not agree as to who should keep this ditch in order, the judge was to decide the question according to what seemed best or necessary. In the ordinance of 1879, a new principle was introduced, viz., that if any one for the cultivation and drainage of his land wishes to carry a ditch to a depth of 4 feet, he is not to be hindered from doing so by the owners of land lying lower down. On the contrary, the owners of land which is benefited by this drainage shall, in proportion to the benefit derived, share in the cost of the draining, including compensation for the ground which is used in digging the ditch, for trespass, etc. It is also prescribed that a ditch shall not be prevented from running out into a neighbour's already existing ditch, but that the cost of the possible alteration of the latter, necessitated by the new influx, and that of keeping the ditch in order, shall be met in the same way as prescribed for the construction of a new ditch.

Much the same principles and prescriptions hold good in the question of *lowering the level of a lake* or of tapping a lake; but public consent, given through the Governor of the Län, is required in this case. Anyone, however, who, in such a matter of draining a piece of water, is not himself a petitioner and does not concur in the petition, can be exempted from sharing in the cost of the undertaking if, within a year after its execution, he renounces before the Governor the benefit accruing therefrom. The expense incurred on account of his land shall be met by cutting off from his share of the improved land as much as corresponds to the value of the improvement to him, and adding it to that of the sharers in the enterprise.

Tenant Legislation.

Tenant Legislation has the same origin as Agricultural Legislation. The regulations brought together in the Code of 1734 can, in almost all their essentials, be traced, not only in the laws of the realm laid down during the latter part of the Middle Ages, but also in various provincial laws. It was, consequently, nothing new that the law of 1734 introduced into the Swedish code. It is all the more worthy of note, then, that, however much agricultural conditions have altered during the period since 1734, tenant legislation itself did not undergo any essential change until the enactment of the law of June 14, 1907, respecting the law of tenant right. If, however, any change in its conditions can be observed this is due to changes in the way of viewing things, and not least to the fact that the relations between landlords (lessors) and tenants, which, as late as 1734, were relations as between master and dependent, have now become, the crofter-system excepted, purely economic relations between two contracting parties on the same footing.

The law of 1907 enacted that leases shall be drawn up in writing, unless the lessor and the tenant are both agreed to have a verbal agreement only. For the sake of security, however, as against a third person, the agreement must be registered, and registration is granted by the court only when the lease is a written one and witnessed by two persons. The lease shall be for a fixed period or for the tenant's life-time, but, in the case of an entailed estate, can only be for such a period as the lessor holds the estate. If the length of the lease is not stated in the agreement, it shall be considered as being for a period of five years.

The law of June 14, 1907, annulled the previously existing right of ending a lease by merely giving notice. In place of this, the law enters in detail into all the circumstances that can confer on the landlord the right to end the lease before the expiration of the stipulated period. The most important of these circumstances are: delay, exceeding a month, in payment of the rent; neglect of the land; subletting the lease to a third person without permission; removal of straw or manure from the farm; damage to land or buildings, etc. In addition, there are enumerated: illegal shooting or fishing; illegal sale of spirits, wine or ale; illegal housing of strangers, etc.

Unless otherwise determined, the rent shall be paid not later than three months before the end of each year of the lease. Should the rent be paid in kind, the tenant cannot be obliged to deliver these products beyond the limits of the land leased, or of the mother-estate of which the farm, etc., forms a part. Should the performance of a certain number of days' work form part of the rent, and if it is not stated in the lease at what period of the year the work is to be done, the total number of days' work shall be distributed equally throughout the weeks of the year, as far as this can be done. Before the beginning of each year of the lease, the landowner shall inform the tenant of the days when he has to perform the work. The obligation of performing the so-called "extra days' work" cannot be legally enforced by the terms of the lease. This provision, therefore, is the first step made by Swedish legislation towards the systematization and legalization of the conditions attaching to crofter-holdings.

The land leased shall be taken possession of by the new tenant on March 14, which, by prescription, is now the legal date for quitting or entering into

possession. The new tenant has the right, however, to obtain possession of one half of the house-room attached to the land two weeks before the date mentioned. The state of the land and buildings, etc., shall be examined by means of inspection (tillträdessyn) carried out before the new tenant enters into possession, and in the manner fixed for the inspection on the termination of a lease (avträdessyn). The tenant has the right of enjoying the use of the fields, meadows, forest-land, buildings and other appurtenances, unless excepted by the terms of the lease. He has not the right, however, to make use of the forest products belonging to the land, nor to take peat from peat-bogs forming part of the land, otherwise than as determined by the lease. Neither may he remove from the land anything — such as gravel, stone, and the like — which does not come under the heading of annual produce of the land. The produce returned by the land can be utilized by the leaseholder, with the exception of that from the timber; manure, hay, and straw, however, may not be removed from the land. An exception to this is formed by the hay and straw which remains unused when a tenant is about to leave, and which the landlord refuses to purchase from him.

The tenant may not sub-let the land or any part of it to any other person without the consent of the landlord. If the lease is for a term exceeding twenty years, however, and should the tenant desire to resign the lease and the landlord refuse to resume possession on payment of a reasonable sum in compensation, the tenant has the right to transfer the lease to another person, unless the landlord can show reasonable grounds for refusing to accept the proposed new tenant. — The death of the tenant does not render the lease void, but the tenant's heirs have the right — if the lease is for a term exceeding twenty years — to offer to return the property to the landlord, at a period not exceeding six months after the death of the tenant. Should he refuse to accept, the heirs can place another, acceptable, person in possession of the land.

The leaseholder is bound to farm the land properly and to take care of, and keep in proper condition, the houses and other appurtenances, so that nothing suffers deterioration during his tenancy. The way in which the tenant has carried out this part of his undertakings shall be investigated by an inspection (see above) to be made not earlier than six months before the day on which the tenant is to leave, and not later than six months after this date. The inspectors shall be two unchallengeable men belonging to the number of the jurats (or certain other authorities), all of whom shall be chosen within the assize-division (Sw. tingslag) in which the land in question is situated. During the inspection, the damage and deterioration is noted and the amount of payment for the same estimated; the total damage, etc., is termed active dilapidation (Sw. husröta). If, when the tenant leaves, the dilapidation is more than when he commenced his tenure, then there exists a surplus of dilapidation (husrötebrist), which the outgoing tenant has to make good. If, on the other hand, it is less, the tenant is entitled to compensation for the improvements. The tenant shall not be entitled to compensation for other improvements, unless in certain cases, than for new buildings, if the landlord has approved the plans, or if the building is otherwise shown to be suitable. The tenant, however, shall receive compensation for the drain-tiles employed for drainage carried out in accordance with a plan approved of by the landlord. If the outgoing tenant has erected other buildings than those required of him, or if he has planted trees or bushes, or in any other special way has expended money on the land, the landlord shall be invited to purchase the same when the tenant is leaving. Should he refuse to do so, the tenant may remove the things on which he has spent money, but if the materials have come from the land, the tenant shall first pay for them. The land and the buildings affected by the removal of the above extra improve-

ments must be placed in the condition in which they were when the tenant began his occupancy.

If the landlord has lent the tenant cattle or implements to be employed on the land, and if a certain value has been placed on what has been thus lent, the tenant shall be obliged, during the period of his tenancy, to keep on the farm, etc., animals or implements of a corresponding kind and value, and the said animals or implements, whether they are the original ones or have been procured during the period of the tenancy, shall be the property of the landlord.

In addition to the above paragraphs, the new law mentioned contains a number of regulations respecting methods and formalities, which would hardly interest the reader.

A proclamation dated June 4, 1908 contains new regulations concerning Crown farm lands let on lease. As a rule, the length of the lease is twenty years, the tenant having priority of choice in the event of a fresh lease being granted at the close of this term. When a lease is granted, it shall stipulate what new erections the tenant is to carry out. If these prove to be greater than will allow of the work being spread over the whole term of tenancy, the tenant can obtain compensation for the superfluous amount, in the first place by means of a reduction of the rent. If, with the consent of the Crown Lands Board, the tenant carries out on a large scale the cultivation of new areas or draining operations, which are to the great advantage of the land, but which, during the period of tenancy, will hardly result in a return to the tenant commensurable with his expenses, he may be compensated by a reasonable reduction of the rent for one or more years. Compensation shall be made in the same way for drain-tiles used in draining operations.

The year before he relinquishes the land, the tenant shall carry out the regular autumn work, such as tilling the fallow, plowing, sowing winter corn and seed for which he shall receive compensation from the incoming tenant. No permission can be given to remove manure, but, on certain conditions, the Crown Lands Board can permit hay and straw to be carried away. A part of this fodder remaining at the close of the tenancy, shall be given to the incoming tenant without compensation. The remainder shall be dealt with in accordance with the general law concerning landlord and tenant.

Respecting the inspections carried out when a tenant takes possession of a farm and when he quits it, the ordinary regulations shall be in force, but, in addition, the Intendant of the Crown Lands shall inspect the land at least once every five years, for the purpose of seeing how the land is being farmed, and whether the tenant is carrying out the various conditions on which the lease was granted.

The Norrland Laws.

A special place in Swedish legislation is occupied by the so-called Norrland Laws, passed in 1906 and 1909, and supplemented in 1912. The *law of 1906,* which affects the Läns of Västernorrland, Jämtland, Västerbotten, and Norrbotten, and parts of the Läns of Gävleborg and Kopparberg, contain **prohibitions for companies or economic associations to acquire landed property** within the various läns, this, with certain exceptions. The chief of these exceptions are: landed estate intended for building plots, storage

places, or the like, or which consists of quarries, gravel- or clay pits, peat-bogs, waterfalls, fishery- or other similar site, or outfield land or forest, which cannot be considered necessary to insure the economic independence of a farm (Sw. stödskog). It is, however, the duty of the Governor of the län where the estate or estates in question are situated, to decide in every special case, after application has been made in the matter, whether such company or association may be permitted to acquire the estate in question.

The *laws of 1909 and 1912,* on the other hand, contain regulations concerning the supervision of certain farm-lands, (vanhävdslag; uppsiktslag) and regulations respecting the leasing of certain land (see below). These laws affect the läns of Gävleborg, Västernorrland, Jämtland, Västerbotten and Norrbotten, and certain parts of Dalarne, and refer only to such landed estates as belong to companies or to economic associations, or private persons who are clearly in the possession of such estates principally for the purpose of utilizing the timber thereon, and who are not entered in the schedules of population as dwelling on the estate, or on an estate which is farmed or managed together with the one first mentioned.

A. **The Inspection of Lumber Farms Law** formerly termed **The Neglected Farms Law.** The proper authorities shall see that the farming of the estate is not abandoned, or the land and buildings otherwise so neglected that there is a danger of the laying down of the farming. This control is exercised by a Commission appointed by the Government for a period of three years, and consisting of a president and two members. Whenever there is reason to suppose that the land is being neglected, the Commission appoints an inspection-committee of three persons to investigate the state of things at the place, and to report thereon to the Commission and, at the same time, to propose the measures the committee may consider necessary for remedying the neglect. Should the Commission consider that the land has been neglected, it must endeavour to make a written agreement with the owner concerning the measures to be taken to bring about an improvement. Not more than four years may be allowed for the carrying out of these measures. If an agreement cannot be made with the good-will of the owner, an action must be brought against him, and the court shall decide what steps the owner must take within a period not exceeding four years.

Should the owner of the land delay the measures that he has either voluntarily undertaken to carry out, or which have been enjoined him by the court, he shall be mulcted in accordance with a scale far in excess of the usual rates of fines, but the fines in question shall not have the alternative of imprisonment attached to them. Finally, it is to be observed that it is the landowner who is responsible for remedying any existing neglect of the land, even if the land is leased to a tenant, and also that a landowner who, voluntarily or by the judgment of the court has had the task enjoined him of remedying the neglect, cannot escape this obligation by selling the land, unless — with the consent of the Commission — the new landowner has undertaken the responsibility in question.

B. **The Farm-lease Law.** The following special regulations are in force, as distinct from these of the general law on tenants' rights. The agreement or lease shall be a written one, and all additions or alterations in the lease shall also be executed in writing, otherwise they lose their validity. If, however, the tenant is found to be farming land and is in possession of no

written lease, the tenant has the right to obtain the necessary lease. Should the landowner refuse to give one, or should he refuse to confirm the conditions of the lease which it is assumed were those according to which the tenant was farming the land, then the court, on the application of the tenant, has the power to confirm the conditions of the lease as far as they can be discovered after investigation, and to the degree that they are in agreement with the law. Such decisions of the court are as binding as a written lease, and, when they have become operative, they can be placed on the records of the court.

The length of the lease is for the tenant's lifetime or for a period of at least fifteen years, unless the parties to the agreement mean to extend the life of a lease which has already been in existence for fifteen years. If no fixed time is mentioned in the lease it is considered as having been granted for fifteen years, and the tenant can claim the right to give notice before the close of the term of the lease. If the period for which the lease was granted has ended and the tenant still remains on the farm, the lease is considered as having been renewed for fifteen years, unless, within six months' time, the landlord gives the tenant notice to leave.

With respect to the rent, it is determined that this can be paid either in money, kind or labour. When the labour consists of farm-work, it may not be so required in respect to time that the tenant is prevented from properly farming his own land. In addition to the amount of day's work or other labour fixed by the lease, there may not be added to the agreement a clause reserving to the landlord the right to claim the assistance of the tenant on other occasions. If there should be a serious failure of crops, the tenant that pays his rent in money or in kind, shall receive a reasonable reduction in the rent.

In general, the tenant enjoys the right, even if no special mention is made of it in the lease, either of resigning his lease, or else of making it over to some other person. In the same way, the heirs of a deceased tenant have the right either to proceed with the farming or, within six months of the decease of the tenant, place another person in his stead, if the landlord will not take back the farm.

During the tenancy of the farm, the landlord is responsible for the erection and repair of the buildings necessary for the proper farming of the land. Should the landlord neglect his duty in this respect, the tenant has the right to call in inspectors, who shall determine the amount of building or repairs to be done, and direct the landlord to take steps to have the work carried out. If the landowner still neglects to do so, the tenant, should he not prefer to resign his lease, has the right to have the work in question done at the expense of the landlord. When the tenant begins his occupancy of the farm, the landlord shall place him in possession of it with all that belongs to it, in a state in accordance with what is customary in the neighbourhood. If the landlord has failed in this respect, the tenant may make good the defects and is entitled to compensation from the landlord for what has thus been done.

In order that both parties to the agreement shall properly perform what the lease enjoins on each of them, an inspection on the farm shall be made when the tenant takes possession, and also when he leaves the farm. When he quits the farm, the tenant has the right to compensation for breaking and farming virgin land, or for work that has permanently increased the value of the farm. Respecting the cultivation of virgin land, however, the law lays down that this must not be done without the consent of the landlord when the land in question is woodland with young trees, or is land where promising young trees are growing. If the tenant intends to demand compensation for the cultivation of virgin land, the consent of the landlord is always necessary before the work is begun, or an inspection must be carried out by a proper person, who shall decide

whether the land is suitable for farming and whether the farming will be of permanent value to the estate.

The compensation may not be fixed higher than an amount corresponding to the expense necessary for carrying out the work, and shall be equal to the amount by which the estate has gained in value by the work at the time when the tenant gives up possession.

An inspection of the farm may also be held during the running of the lease, partly for the purpose of seeing if the landlord has carried out the repairs, etc., enjoined on him in order to make good the defects that may have existed at the inspection held when the tenant took possession, and also to see whether such work, or other work voluntarily undertaken by the landlord, has been properly carried out.

If there is not sufficient pasture on the farm for the cattle and horses which can be fed there during the winter, and if the farm form part of a larger estate of the landlord's, the tenant shall obtain the necessary pasturage in the woods or outfield belonging to the estate.

The tenant has the right to obtain wood for house-fuel and the timber necessary for repairs, fences, the short wooden fences used in Sweden for drying hay, ditching, and implements. Should the woods on the tenant's farm, or on the home-estate of which the farm forms part, during the period of tenancy have been so diminished, in consequence of the action of the landlord, that the tenant is unable to obtain from the said woods all the timber or forest-products to which he is entitled, the landlord is obliged to make good in some suitable way what is wanting in this respect. Otherwise the tenant shall not take timber, etc., from the landlord's woods, unless a special agreement has been made in the lease.

The landlord has the right to give the tenant notice to return the lease if, in general, the tenant has been guilty of the same faults and neglect as those mentioned in the general law of tenant right. In addition, however, there is another circumstance that may lead to the confiscation of the lease, viz., if the tenant leads, or allows others to lead, a wicked and licentious life, such as may tend to give the estate a bad reputation.

Finally, it should be observed that the Governor of the län can suspend the action of this law or of any certain part of it, should there exist any special circumstances making such a course necessary.

Remark. For particulars concerning **agricultural labourers,** see the article Labour Conditions and Workmen's Wages (Part I).

IV.

FORESTRY.

I. FORESTS.

Of the 41 million hectares constituting the total area of Sweden, if the inland waters be neglected, it is estimated that, at the present moment, 21·6 million, i. e. about 52 %, or somewhat more than half, is covered by forests. Among all the countries of Europe it is seen that only Finland has a larger proportion of its surface covered with timber than Sweden. The average figure for Europe as a whole is 33 %; that for the western portion of the continent not more than 25 %.

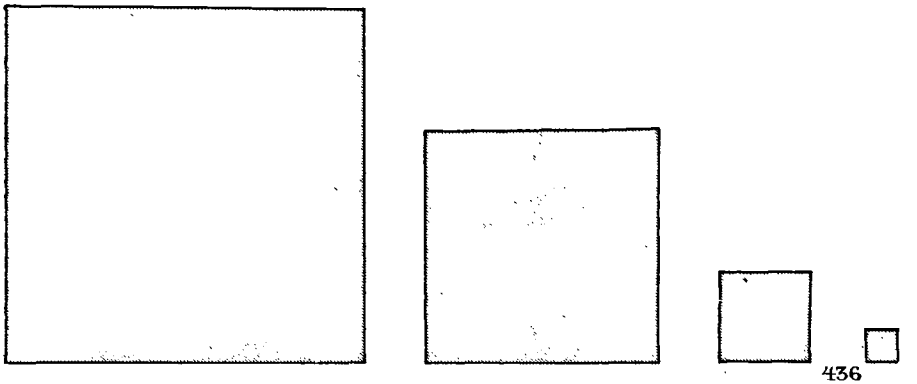
On an average, Europe has about 74 hectares of forest-land for every 100 inhabitants. Western Europe, however, has only 37, while the figure for Sweden is 392. In this respect, too, Sweden stands next to Finland among the countries of Europe. A comparison between Sweden and some other countries from this point of view is given by the diagram on page 167.

If we deduct from the total land-area of Sweden that part which is employed for higher cultural purposes than the production of timber, viz. for building sites and gardens, cultivated land and natural meadow-land — altogether 5 million hectares — there remain, in round numbers, 36 million hectares of "outfield"-land.[1] Of this area, about 7 millions hectares lie above the pine-forest limit in the Läns of Kopparberg, Jämtland, Västerbotten, and Norrbotten. By far the greater part of this soil is the property of the State; fell-land belonging to private individuals is found

[1] Outfield land is that part of the total area of the country which remains after the deduction of arable land and natural meadows.

Forest-bearing Areas.

Hectares per 100 inhab.



Sweden 392 har | Russia 168 har | Germany 22 har | British Isles 3 har

mostly in Jämtland Län. In 1913, the outfields were divided between public and private ownership in about the following proportion:

Forests belonging to the State	8·3	million hectares
Undelimitated lands[1] belonging to the State, inclusive of the naked fells in the Läns of Västerbotten and Norrbotten	5·2	» »
The property of towns, hundreds and parishes (rural)	0·7	» »
» » » individuals	21·8	» »
Total	**36·0**	million hectares

According to this above table, therefore, 37·5 % of all the outfield-land of Sweden belongs to the State; 1·9 % is the property of towns, hundreds, or parishes, and 60·6 % belongs to private individuals.

Of the total amount of outfield-land, or 36 029 088 hectares, no less than 14 405 480 hectares are timberless, some in consequence of the land lying above the forest-limit, and some, lying below that line, because the soil itself is irreclaimable, consisting of rocks, bogs or morasses, or, for one reason or another, is marked by an absence of timber, as in the case of heather-covered moors, fire-ravaged areas, or areas where the trees have newly been cut down. The **wooded area,** therefore, amounts to 21 623 608 hectares. These figures (concerning 1911), however, are considered as somewhat unreliable.

In calculating the national wealth of Sweden, the value of the timber and the timber-covered land was estimated in 1908 as follows:

Forests belonging to the State	230 439 000	kronor
Other public forests	79 104 000	»
Private forests	1 247 651 000	»
Total	**1 557 194 000**	kronor

[1] Delimitated land (Sw. avvittrad mark) is the term employed to distinguish the tracts of land which, after survey, are apportioned between the State and private persons.

Public Forests.

The greater part of the public forests, including those not belonging to the State, are either managed by, or stand under the superintendence of the *Crown Lands Board,* which also has the administration of the agricultural domains belonging to the State.

The **area of the public forests** amounted to **8 964 663** hectares in 1913. The corresponding figure for 1911 (for which year more complete returns are available) was 8 958 448 hectares, 4 988 912 hectares of this consisting of timber-producing land, and 3 969 536 hectares of irreclaimable land. Among these forests are included such as belong to hundreds and communes viz.:

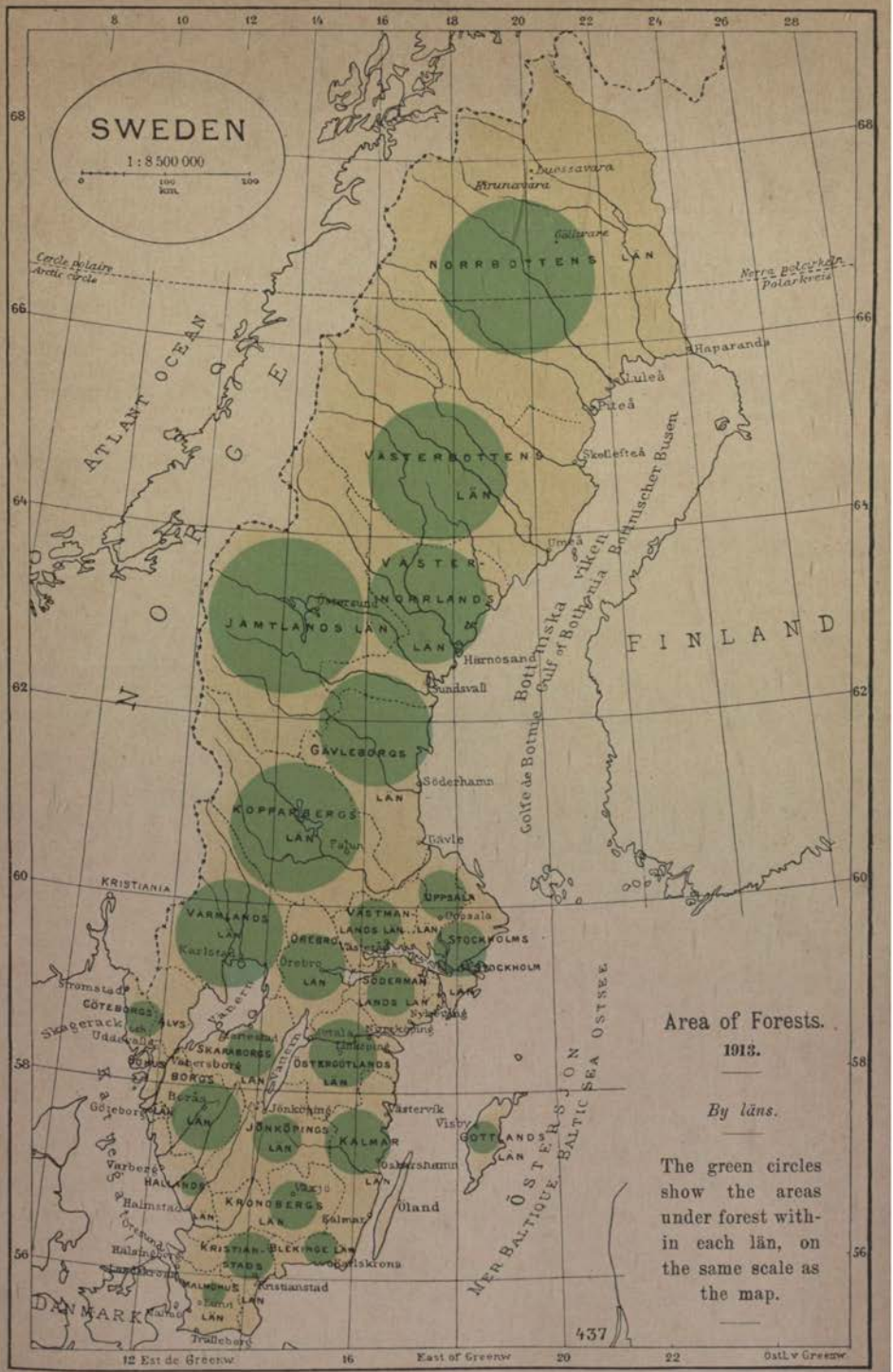
Forests belonging to the Hundreds etc. (Commons)	98 937	hectares
» » » » Towns	34 947	»
» » » » Parishes (rural)	559 601	»
Total (1913)	**693 485**	hectares

A) The State Forests, in the wide sense of the word in which the term has been employed, above, were distributed as follows, the areas being given in hectares. (The irreclaimable land is, as a rule, included.)[1]

	In 1890	In 1900	In 1913
Crown Parks	3 408 751	4 518 066	4 679 968
Crown lands not yet organized[2] . . .	1 049 249	927 671	1 204 051
Forests of the Crown Domains . . .	240 710	171 518	136 565
» » » civil tenures[3]	16 920	14 055	12 105
Plantations on drift-sands	1 397	1 333	1 349
Total A	4 717 027	5 632 643	6 034 038
Forests let to Mining Cos.	40 604	32 572	36 109
Forests let to Saw-mill Cos.[4]	269 070	119 835	52 959
Belonging to ecclesiastical benefices .	342 083	348 952	353 655
» » public institutions . . .	33 379	43 347	40 844
» » Crown farms[5]	1 472 907	1 128 044	699 300
Total B	2 158 043	1 672 750	1 182 867
Grand total hectares	**6 875 070**	**7 305 393**	**7 216 905**

In addition to the above, there are the forests on the reindeer grazing-grounds on the fells, which grounds embraced 1 051 065 hectares in 1913. Of this area, however, 887 398 hectares consisted of naked fells and other irreclaimable land, while 3 208 hectares were smaller plots of Crown lands let on lease (Sw. "kronolägenheter"), islands, and skerries. The diminution in the area of the forests belonging to the State as shown by

[1] In part there are also included in these figures other public forests than those of the State; cf. the text. — [2] (Sw. "överloppsmarker") Grounds left in possession of the State after delimitation (v. p. I, 226.), or which have not been delimitated but which are considered to remain State property after the delimitation is completed. — [3] Held by Civil Servants of various classes. — [4] The "stockfångst" forests as they are called. — [5] Inclusive of the woods belonging to new settlements. Crown farms (Sw. "kronohemman") are farms held on lease from the Crown, against payment of special dues.


SWEDEN
1 : 8 500 000
0 100 200
km
Cercle polaire
Arctic circle
Norra polcirkeln
Polarkreis
ATLANT OCEAN
NORGE
FINLAND
Luossavara
Kirunavara
Gällivare
NORRBOTTENS LÄN
Haparanda
Luleå
Piteå
Skellefteå
VÄSTERBOTTENS LÄN
Umeå
VÄSTERNORRLANDS LÄN
Östersund
JAMTLANDS LÄN
Härnösand
Sundsvall
Bothniska viken
Gulf of Bothnia
Bothnischer Busen
Golfe de Botnie
GÄVLEBORGS LÄN
Söderhamn
KOPPARBERGS LÄN
Falun
Gävle
KRISTIANIA
UPPSALA LÄN
Uppsala
VÄSTMANLANDS LÄN
STOCKHOLMS LÄN
Stockholm
VÄRMLANDS LÄN
Karlstad
ÖREBRO LÄN
Örebro
SÖDERMANLANDS LÄN
Nyköping
Stromstad
GÖTEBORGS LÄN
Skagerack
Uddevalla
Vänern
Karlstad
SKARABORGS LÄN
Vänern
Metala
Linköping
ÖSTERGÖTLANDS LÄN
Vänersborg
BORGS LÄN
Borås
Göteborg
Jönköping
JÖNKÖPINGS LÄN
Västervik
Visby
KALMAR LÄN
Oskarshamn
GOTTLANDS LÄN
Varberg
HALLANDS LÄN
Halmstad
KRONOBERGS LÄN
Växjö
Kalmar
Öland
Öresund
Halsingborg
KRISTIANSTADS LÄN
BLEKINGE LÄN
Karlskrona
Landskrona
MALMÖHUS LÄN
Kristianstad
Malmö
Trälleborg
DANMARK
ÖSTERSJÖN
MER BALTIQUE
BALTIC SEA
OSTSEE
437
12 Est de Greenw.
16
East of Greenw.
20
22
Östl. v. Greenw.
Area of Forests.
1913.
By läns.
The green circles show the areas under forest within each län, on the same scale as the map.
123 483
Gen. Stab. Lit. Anst. Stockholm

the grand totals for 1900 and 1913 is explained by the fact that a great deal of Crown leased farm-land has passed to the category of taxed land now owned by the farmer (Sw. "skatte").

Under division A above, are given the forests-lands belonging to, or leased out by, the State itself, while division B shows the land let for other purposes. The Crown islands belong to the former category; the Laplanders' tax-fells ("lappskattefjäll") to the latter group. Some of the lands given in group B do not belong to the State.

The direct *revenues* from the Crown parks, from forests reserved by the State when leasing out Crown domains, and from the remaining non-organized Crown lands, etc. (the "Forest revenues" of the Public Treasury) were as follows:

	1890	1900	1913
Gross receipts	3 190 426 kr.	8 318 927 kr.	14 878 818 kr.
Expenses of forest administration	947 883 »	1 855 284 »	5 280 619 »
Net receipts	2 242 543 »	6 463 643 »	9 598 199 »

These figures show a considerable increase in the income received by it was impossible for the State to carry on business enterprizes with years, is partly the result of the unusually favourable state of the markets everywhere in the world.

The Crown Parks.[1] Influenced by the political-economical views, that it was impossible for the State to carry on business enterprizes with any great amount of success, the greater part of the Crown forests in the southern provinces of Sweden, during the period 1810—30, was either given away, or sold to private individuals at exceedingly low prices. In the northern Läns, too, at the great "delimitation", when vast tracts of land not under cultivation were divided between the Crown and private owners, the rights of the Crown were for a long time quite neglected, and sections of forest-land were apportioned to farms which were altogether out of reasonable proportion to the value of the farm as a whole. After the rise in the value of forest-products which everywhere took place about the middle of the 19th century, the forests in question became the objects of brisk speculation, and soon passed into other hands for the purpose of cutting, very often without any regard to the future prosperity of the farms. This called public attention to the fact that the State should, for the future, take care of and utilize its supply of forest-land, especially as it still possessed vast tracts of land in Norrland and in a part of Dalarne.

Consequently, ever since the decade 1860—70, the Swedish State has acted on altogether new principles as regards the care of its forest domains, and with very evident results, as will be seen when we state that, such a short time back as in 1870, the total area of the Crown parks amounted to no more than 425 794 hectares, while, in 1913, as shown above, the domains in question covered 4 679 968 hectares. At the present time, this area is steadily increasing, partly by the addition of the remaining Crown

[1] Fully organized State forests.

land to the total, whenever delimitation is carried out, and also by the addition to these Crown parks of timbered land belonging to the Crown's former agricultural estates.

The area of *the land purchased* since 1875 by the State for the purpose of adding to the Crown parks is shown by the following figures:

Year	Area	Price	Per hectare
1875	1 876·09 hectares	51 634·00 kr.	28 kr.
1876—80 . . .	11 368·20 »	778 558·98 »	68 »
1881—85 . . .	952·60 »	100 487·36 »	105 »
1886—90 . . .	44 660·69 »	1 353 823·70 »	30 »
1891—95 . . .	46 995·72 »	2 530 689·42 »	54 »
1896—00 . . .	134 451·69 »	7 889 068·38 »	59 »
1901—05 . . .	54 756·09 »	5 249 207·50 »	96 »
1906—10 . . .	49 855·98 »	5 024 716·55 »	101 »
1911—13 . . .	38 258·41 »	4 208 988·39 »	110 »
Total	383 175·47 hectares	27 187 174·28 kr.	71 kr.

These purchases of land have, for the most part, been made in the southern and central parts of the country.

Space does not allow of more than the following short remarks concerning **the remaining part of the State forest land.**

The area of the **Crown "överlopps"-lands** (v. note, p. 168) amounted in 1913 to 1 204 051 hectares, of which, however, no less than 884 112 hectares consisted of irreclaimable land.

Woods belonging to the **Crown agricultural domains let on lease** have a total area of 136 565 hectares. The area of these woods diminishes, partly in consequence of the sale of the farms, and also because certain of the woods are reserved to add to the Crown Parks.

The forests held on civil tenures are, as a rule, attached to the residences of rangers and constables, and have a total area of 12 105 hectares. This area is growing less, however, in consequence of the resumption by the Crown of such residences, these being then either sold or let.

The drift-sand plantations, situated in the Läns of Blekinge, Kristianstad, and Halland, embrace 1 349 hectares.

Forests belonging for the most part to the State and under its administration, and which have been devoted to various other purposes, are, in the tabular summary on page 168 entered in division B. Under this heading come the different kinds of forests mentioned below.

The Laplanders' tax-fell or reindeer-grazing fell-forests, as they are also called had in 1913 an area of 1 051 065 hectares, of which 163 667 hectares were timbered. The revenues from these woods are paid into a fund, which is employed, amongst other things, for the purchase of the land necessary to provide grazing grounds and wandering-roads for the reindeer.

The forests assigned by the State **for the support of the mining industry** embrace 36 109 hectares. A part of this area has been re-appropriated by the Crown, however; the conditions as a result of which the grant was made no longer existing.

The area of **forests allotted for supplying saw-mills with timber** amounts to 52 959 hectares. At the close of the 18th century and during the first part

of the 19th, the State tried to support the saw-mills in Norrland by guaranteeing to certain saw-mills the right of felling from the Crown forests a larger or smaller number of marked trees at a fixed price. To the saw-mills thus privileged there was soon given the right to have woods set apart — "stockfångstskogar", as they were called — for the cutting of timber. Later on, however, it proved that these forest-domains assigned to the saw-mills were able to yield considerably greater quantities of timber than the annual amount of timber or trees assigned by the privileges first granted, and difficulties arose as to the right of disposal of this excess. In consequence of this and other reasons, an agreement has been come to since 1885, between the State and the holders of the privileges, whereby the latter, in consideration of being allowed to cut down all the timber in the said forests, up to a certain dimension lower than that fixed by the original grants, agree to restore the forests to the State as soon as the timber has been cut down, and to renounce all further claim to the woods and timber in question.

From Nordingrå in Ångermanland.

The area of the forest- and pasture land appertaining to ecclesiastical benefices amounts to 353 655 hectares. The timber obtained every year is allotted, in the first place, to the household needs of the holder of the benefices and to the timber-supply of the parish, when a rectory or (although with certain restrictions) a church is to be built. The remainder of the ordinary production of timber is, as a rule, divided between the clergyman and the general "Regulating-Fund for the Stipends of the Clergy", while the money received from the sale of surplus timber (such as that obtained when making improvements and clearings), which is not required for the household supply above mentioned, goes to the "Forest-Fund for Clergy benefices", which defrays the expenses of forest surveying and of wood-plantation at such ecclesiastical residences as do not own timber-supplies sufficient to provide means for these purposes. In the case of ecclesiastical residences which have been purchased by the parish-

es, or which have been donated by private individuals, the timber produced is assigned to the benefit of the clergyman residing in the said house and of that of the parish, in accordance with a special resolution of the Government and the tenor of the deed of gift. The new legislation regarding these matters will bring about essential alterations in the method of disposal of the timber obtained from the church-forests. As a rule, the rectories and other dwellings of the clergy will be let, and the timber obtained each year will, in the first place, go to supply the household needs of the lease-holder. If there be a sufficient supply to enable it to be done, the holder of the benefice will also be given timber for his household needs, and the parish will receive building timber for the rectories and the churches. Money received from the sale of timber from the church-forests will, as a rule, be placed in the church-fund, which will be formed from the existing ecclesiastical funds.

The area of forests belonging to **Public Institutions** such as churches, academies, hospitals, etc., amounts to 40 844 hectares.

Forests appertaining to Crown farms and settlements. Their return goes to the tenant. The total area amounts to 699 300 hectares.

B) The total area of the **Forests belonging to the Hundreds** (the Common Forests) amounts to 98 937 hectares. The part-owners in the forests of a hundred are the persons that live in that hundred, and their shares are in proportion to the number of original taxation-areas each occupies. The forests of the hundreds may not be divided, but must be kept undiminished in area and must be cared for in accordance with such economic principles — based on scientific principles — as aim at the continued survival of, and the greatest returns from, the forests. If the common forest of a hundred has not been placed under the administration and care of the Forest Service, the State foresters shall, nevertheless, see that the economic principles laid down for this class of forests are followed. The products obtained form the forest of a hundred are used. in the first place, to defray the expenses of the keepers and the management; secondly, for such building purposes as are common to the whole hundred, and lastly, for distribution among the part-owners.

C) The Parish Forests amount, altogether, to 559 601 hectares. The parish forests (the forest-commons of the parishes) in the Län of Norrbotten are under the care and administration of the Forest Service. They were formed by the land-owners of the various parishes having decided at the "Delimitation" to reserve part of their forest-grant to form common forest land. The area of such forests amounts to 292 295 hectares. The existence of the parish forests (surplus forests and forest-commons) in the Läns of Gävleborg and Kopparberg is due to the fact that, at the "general repartition of land" (v. p. 31), large areas of forest were granted to certain parishes, on condition that the said forests should be employed for the purpose of forming parish-forests common to all the landholders. The area of these forests is 267 306 hectares. The regulations in force with regard to their care and management impose very slight restrictions on the part-owners' right of disposal of the timber obtained, so that the forests may, in some cases, have been too freely thinned. Considerable

funds have been formed, however, from the revenues obtained, and they are employed for the common needs of the various parishes. (See p. I 291.)

D) The Forests belonging to Towns embrace altogether 34 947 hectares. They are to be subjected to well-ordered management in accordance with plans drawn up by the Crown Lands Board, which aim at the continued survival of, and at the securing of the greatest returns from, the woods in question. Even before such regulations were issued in 1903, forest-bailiffs had been appointed for the forests which belonged to certain towns and which were found to be well cared for.

As a general verdict concerning *the condition of the public forests* it has, not without reason, been pointed out that, in consequence, as a rule, of a too conservative administration, the supply of timber has become greater than a rational economic system required. This has led, during the last few years, to gradually increasing cutting, while, at the same time, efforts have been made, as far as the supply of labour and other conditions have rendered it possible, by means of thinning and clearing operations, to utilize the less valuable forest-products which were formerly allowed to decay in the forest. The first condition for profitable forest economy is that a paying market can be found for such second-rate timber. The increased output of the woodpulp works and the growth of the net of railways, among various other causes has, during the last few years, led to a partial change in this respect, in the more northerly parts of the country especially. In addition to this, over considerable areas in the districts in question, in the neighbourhood of the rafting streams and railways necessary care can nowadays be given to the growing timber. The red line on the accompanying map shows, approximately, the extent of the districts where timber for pulpworks and charcoal-burning, or for one of these purposes, is in demand. In the tracts west and north of this line, therefore, there do not at present exist the conditions necessary for good forest economy, as the only timber from these tracts which can be sold is still that of larger dimensions, for the sawmills industry. For this reason, timber-cutting *en masse* remains for the present a compulsory method of lumbering, from which, east and south of the limits marked on the map, it is possible to revert to such forms of forest economy as make it possible to pay more attention to the care and re-growth of the timber. In this connection, however, it should be mentioned that the above-mentioned conditions for profitable forest economy can also lead to the cutting-down of timber on too large a scale. Such excessive lumbering, whereby the supply of timber is diminished, can, in certain cases be justified, should the supply in any forest be abnormally large, or should it consist of over-mature, degenerated or too densely growing timber, in which case forestry demands the felling of timber on a large scale during a suitable transition period. But in many cases this cutting of timber on a large scale is not done for the motives

mentioned, even though it may be carried out in connection with proper care of the forest-land and the remaining trees. If the two latter conditions do not exist, such excessive cutting of timber can be described as nothing short of forest devastation.

Private Forests.

As was shown above, by far the greater part of the forests of Sweden, together with irreclaimable land amounting to about 22 million hectares, or about half the area of Sweden, belongs to private owners, and private forest-economy thereby becomes a question of the very greatest importance for the country. The way in which the private forests have been managed has not generally conduced to the preservation of the timber. For the Läns of Norrbotten and Västerbotten, and the upper parts of Dalarne (the parish of Särna), as well as for the island of Gottland, the proprietory rights of the owners of private forests have been limited by special laws, in consequence of which the supply of timber has been well preserved in the Lappland districts and in the parish of Särna, though less so in the Län of Västerbotten and in Gottland.

A survey of the condition of the private forests in the other parts of Sweden gives the following result.

With respect to the condition of the forests south of the Läns of Norrbotten and Västerbotten the three following regions can be distinguished:

a) Central and Southern Norrland and Dalarne, as regards the timber export of Sweden, are of greater importance than the entire remaining part of the country. Excessive felling of large-sized timber is considered to be general, and the same may be said of timber of smaller dimensions in districts possessing good communications, especially in the littoral districts. A considerable number of large forest owners, however, take great care of the woods.

b) The Bergslags district embraces a belt of country from, and inclusive of, Värmland to, and inclusive of, Stockholm Län, or that part of the country where mining operations are chiefly carried on. The woods show great powers of recuperation but are, as a rule, thinned to excess, an evil that has increased since the saw-mill industry became more general. The re-growth of the forests after felling for charcoal-burning purposes is good, and the woods belonging to the iron-works are, as a rule, carefully looked after.

c) The forests of *the country south* of the belt above mentioned no longer support any great industries. Among the timber-exports, which, in proportion to the supplies of timber, is very considerable, there is a relatively large percentage of small-sized wood, such as pit-props, spars etc. The greater number of the woods belonging to farms, especially the smaller ones, often resemble badly cared-for pasture-land, where birch, aspen, alder, and other deciduous trees form a large proportion of the thin woods. In order to increase the pasture-land, the woods are usually kept thin, the same need for grazing land also helping to counteract any inclination to afforest naked land. Large forest owners, however, in many places take exemplary care of their forests.

Although the economy of the private forests of the country must be considered as having improved since the coming into force of the forests-

laws issued in 1903, the forests in question are partly in a neglected state, and, as a rule, they suffer from *excessive lumbering*. It is true that exact figures do not exist to show the extent to which this excessive felling of timber is carried on, as, in order to obtain such figures, an exact knowledge is required, not only of the annual growth of the forests, but also of the amount of the timber cut every year.

Various associations, however, have long been labouring for the promotion of forest-economy in Sweden. The most important of these associations is that called the "*Svenska Skogsvårdsföreningen*" (Swedish Forest Conservation Association), which was formed in 1902 (under the name "Föreningen för skogsvård"). Since 1903, the association has issued a journal and also, for many years, popular papers, which, from the year 1914 inclusive have been replaced by a small journal. The association which, one year after its establishment, numbered almost 1 400 members, now has about twice that number. It arranges annual meetings and excursions, and, among other things, devotes special interest to the question of a general survey for the purpose of estimating the entire timber-supplies of the kingdom. In order to obtain a thorough investigation of this question, the Riksdag granted the means necessary to carry out an experimental valuation of the timber-supply and the probable increase in Värmland Län. This valuation has now been carried out.

The first, in point of time, of the associations in question is the "Föreningen för skogsvård i Norrland", which, since 1914 inclusive, has been re-organized as "*Norrlands Skogsvårdsförbund*" (The Norrland Forest Conservation Union), two other associations working for the same ends having been incorporated with the body first mentioned. The Union dates back to 1883, since which year it has been actively engaged in the promotion of forest economy in Norrland, by such methods as holding meetings and arranging excursions, and by issuing small publications, year-books handbooks, etc. In other parts of the country, too, there exist active associations for the promotion of forest economy, such as "*Skogssällskapet*" and others.

In the absence of reliable statistical information with regard to the produce of the forests and the consumption of timber, the reader must be satisfied with the following approximate calculation.

The Produce

of the forests of Sweden, or the annual growth *that can be used*, has been very variously estimated. In general, all older calculations suffer from a common fault, viz., all of them are too low, and the result of this has been that altogether too gloomy a view has been taken of the future of the forests. The usable, annual produce, too, has long been on the increase, partly in consequence of the more extensive employment of a rational system of forestry in the care both of the public and a considerable number of private woods, and partly because the forest-products are turned to better account than formerly, and also because fairly extensive areas of naked soil have been afforested and thus rendered productive. At present, the annual growth in question need not be set lower than 35 million cubic meters.

The following calculation has been made respecting the **consumption** of timber during 1913:

Exported unwrought and hewn timber	1 344 679	cub. m
Exported sawn timber	4 778 911	»
Exported more or less wrought timber, exclusive of wood-pulp	875 457	»
Timber employed for wood-pulp	4 360 528	»
Timber » » mining purposes	6 000 000	»
Timber » » other purposes	21 000 000	»
Total	**38 359 575**	cub. m

The present consumption, therefore, should exceed usable growth by about 3·36 million cubic meters annually. It should be remarked, however, that the total growth is greater than the amount of timber that is employed, as, in certain tracts, a part of the timber that could be felled cannot be utilized, but has to be left to decay in the forests. For example, in the woods of Norrbotten and Västerbotten Läns, not less than 25 % is thus left to decay; in the other parts of Norrland and in Dalarne, the proportion is about 15 %, while in Central and Southern Sweden, it is about 5 %. The rising prices of timber, a consequence of diminished supplies and improved communications, are leading to the result that, in every part of the country, the timber is turned to better account from year to year, a circumstance which, of course, tends to diminish the excessive felling referred to above. But on the other hand, the consumption is continually on the increase, and it would be difficult to prophesy whether equilibrium can be reached, so that the consumption (the amount of timber felled) will be quite balanced by the amount of the growth. The production of timber will probably increase in no inconsiderable degree, but the consumption of forest-products to supply the requirements of the country itself grows with the increase of population more rapidly, perhaps, than that of the forest-production. If it were possible to diminish the amount of timber employed as fuel by an increased use of — amongst other resources — electric power obtained from the Swedish waterfalls, for the purpose of heating dwellings in towns and other large centres of population, it would be an easier task to limit the excessive felling of timber.

The re-growth of the forests takes place chiefly by nature's own efforts; even in those places where care is taken of the forests, this must still be the case to a very great degree, especially in the northern parts of the country, for there the period of the year when re-planting ought to and can take place is short, and labour is dear. Seed suitable for the district has to be gathered in the same tract, this being a more expensive matter here than in the more southerly parts of the country. In consequence, when the timber is being felled, suitable seed-trees are left for the purpose of sowing the surrounding soil, and other measures are taken to assist the growth and development of the young trees. For this purpose, in many places, the ground is prepared by means of the wood, or hoeing the ground to assist the natural sowing. The spruce, however, is not left singly, as this tree is liable to be broken down by the wind; however, it reproduces itself readily by seeding from the skirts of adjacent woods.

Re-growth by means of **forest-plantations** occur most generally in the southern and central parts of the country. During the last decade, the Forest Conser-

vation Boards have done a great deal to promote forest-plantation, which method, in consequence, has gained the confidence of the forest proprietors to a greater degree than formerly. This method, too, makes it possible to determine the composition of the future forest as regards the proportion in which the various kinds of trees are to be represented there. Forest-plantations are raised either from seed or froom seedlings. Although the pine and the spruce appear almost spontaneously side by side, mingled together, a condition of things that seems to promote the well-being of each, it has been found that, where both kinds of trees are artificially planted simultaneously, groups or belts of each kind of tree should be arranged, so that the one kind of tree may not crowd out the other which happens to be more tardy of growth. In this respect it has been found that if the soil is more suitable for one kind of trees, the best plan is to give the less favoured tree a start of some years' growth. For this purpose sowing and planting are sometimes carried out simultaneously, the tree that has to be given a start being planted, and the other being reproduced by means of seed. When assisting nature in the case of incomplete re-growth after artificial or natural sowing, planting is employed, too. Planting, which is dearer than sowing, although young plantations are thereby obtained in shorter time, is being employed on an increasing scale in Sweden, especially in places where the land is of greater value, the increased cost of cultivation being balanced by the advantage conferred by earlier returns from the forest-products.

The expense of forest-cultivation as regards the public forests amounts annually to more than 370 000 kronor, by far the greater part of this total (or about 240 000 kronor), being expended in the southern and central parts of the country. In Norrland and Dalarne, however, forest-plantations are being resorted to more and more, both in the State forests and in those belonging to private owners.

For the promotion of the economy of private forests, there is a Forest Conservation Board in every county council district south of the two northernmost Läns. These Boards have placed at their disposal every year a State grant of 100 000 kronor, for the promotion of forest-cultivation, and another amounting to 67 500 kronor, to help to cover the expenses of the Boards. In addition to this, the Boards are granted a total sum of 100 000 kronor by the County Councils and the Provincial Agricultural Societies, besides which there are the fees paid for the care and supervision of the forests, now amounting to about 1 000 000 kronor annually. Although the care of private forests has considerably improved during the last few years, there still exist great short-comings in this respect, for which the Forest Conservation Boards have proposed the enactment of severer laws and an increase in the amount of the grants. The area covered by the forests in each of the läns of Sweden was estimated in 1911 as being of the extent shown by Table 9, on p. 43.

A diagrammatic survey is given by the map on p. 169. Of all the forest-land of Sweden, two-thirds lie north of the River Dalälven. In proportion to the area of the provinces, the far north of the country is not so rich in forests, a great part of the land here lying above the forest-limit. The läns of Värmland, Kopparberg, Gävleborg, and Västernorrland, are those relatively richest in forests, from 67 % to about 80 % of the land there being timbered.

Legislation and Administration.

Forest Legislation in Sweden was first concerned with the regulation of *public* forests. Mention is made of *commons* in the earliest existing legal contracts and charters. Under that designation were included those stretches of wooded land that intervened between the tracts of cultivated country; these intervening stretches were considered by the owners of the adjacent land as necessary, both for yielding them forest produce and for allowing them an opportunity to extend the cultivated land in their possession.

Hence these wooded tracts could not be appropriated by any one who chose as was the case with waste land. Sometimes, however, the name "commons" is found applied to these waste lands, which by degrees came to be regarded as State property. In the proclamation of Gustavus Vasa, dated April 20, 1542, it is declared that "uncultivated tracts of land belong to God, the King, and the Swedish Crown". These tracts were not, however, dealt with exclusively as the property of the State; they were, on the contrary, held disposable for the furtherance of land-cultivation, on the one hand by apportionment of land for colonization by settlers (in Norrland), and on the other by the grant of the right "to such cultivators of the soil as do not enjoy it in woods of their own, to make use of pasture, timber, fencing-material, leaves for fodder, birch-bark, peat and bast, besides other things to be found there, to supply their own bare necessaries". This enactment gradually produced the impressions in the minds of the people that these commons were public forest-land, belonging in some cases to parishes, in others to hundreds. Those that belonged to the parishes have, with few exceptions, been divided between the part-owners, while those belonging to the hundreds remained intact and under the control of the State. In some instances the tracts were retained as State property and were transferred to Crown parks, after investigations had been made concerning their nature.

Public forests are either managed entirely by the State Forest Service, or are under the superintendence and control of that body. In nearly every case the end aimed at is to render their economy as permanent as possible. The two factors, personal, technical knowledge and permanent economy, were the fundamental principles of the strongly conservative, but — for its era — excellent (when permanence was secured), care taken of that group of forest especially which was under the direct administration of the State Forest Service. As before stated, this administration is nowadays extended to Crown parks, State lands not yet organized, drift-sand plantations, mine forests, many commons, forests attached to civil tenures, the Crown domain forests let out on lease, and the forests belonging to one town. Under the superintendence and control of the State are the other commons, forests attached to residences, and those belonging to the towns, as well as those which are the property of public institutions, the forests left to supply saw-mills with timber, etc.

The appreciation of the use and necessity of personal, technical knowledge found expression in the legislative measures which were passed in 1903 for the purpose of ensuring the proper care of **private forests.**

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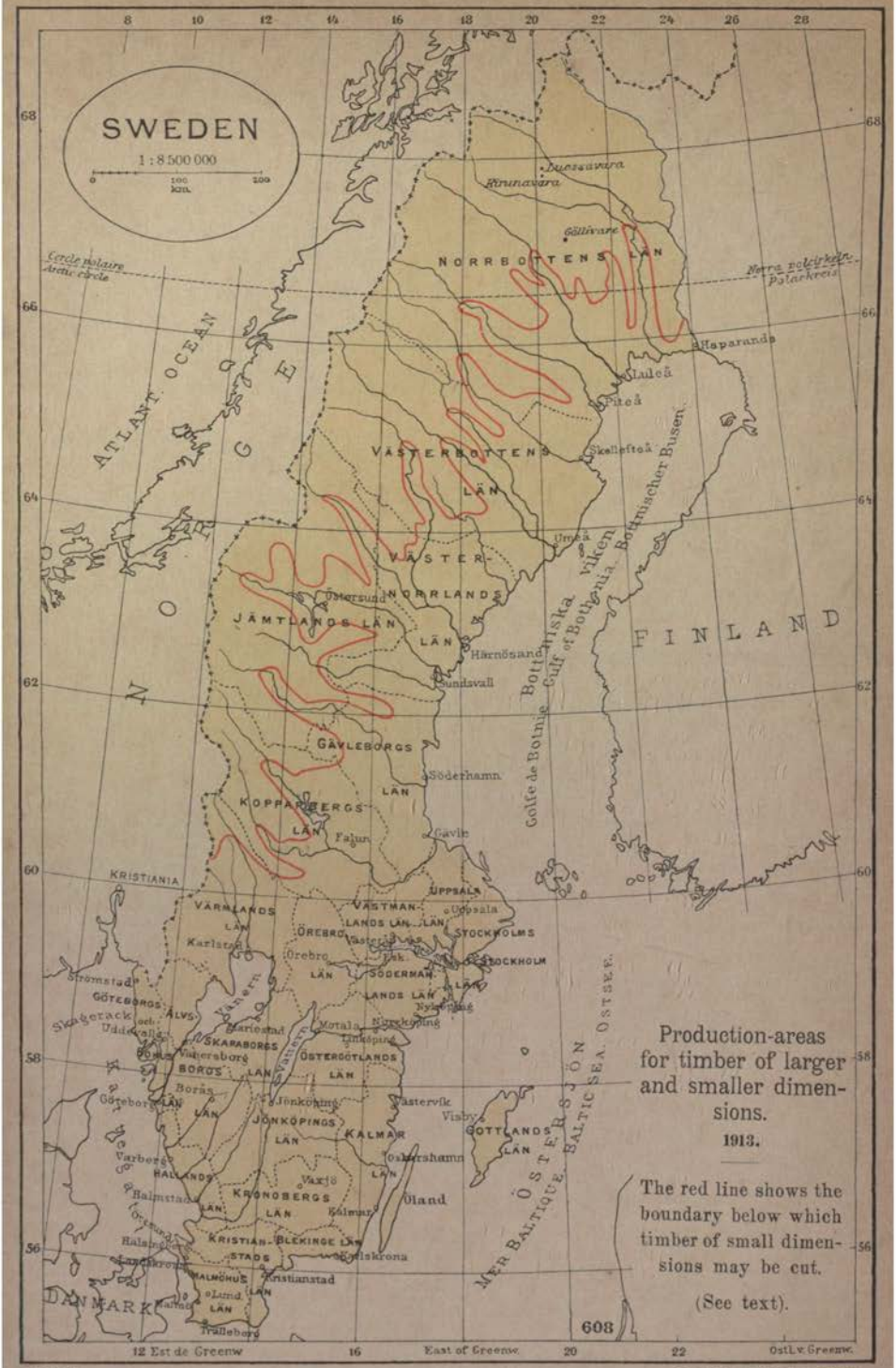
The legislation concerning these forests has, in the past, gone through highly remarkable phases of development. From complete freedom, three hundred years ago, they were by degrees made an object of increasingly severe legislation, and finally even lumber-felling for household purposes was placed under the control of the State. Then followed a reversion, which at last once more led to nearly complete freedom. During the last five decades a reaction has set in, imposing several restrictions upon private forest-owners with regard to the management of their forests.

This legislation commenced so, that the right to establish settlements and get them converted into the tax-farms ("skattehemman") was attached to the condition that the forests belonging to farms founded in this way could be freely used only for household needs, while timber intended for sale had to be chosen and marked by the proper forester before the felling. It was, however, only by the Royal Ordinance of June 29, 1866, that this instruction was given for the six northern Läns. The settlement system had before been so one-sidedly encouraged, that in many places it had degenerated into forest speculation under the guise of land cultivation. And as the permission to establish settlements concerned not only "undelimited" forests, but also such areas as remained after "delimitation" had taken place, there was in many places but little woodland left for the State. By Royal decree of May 16, 1860, it was, therefore, ordained that an examination should be made of the said "överlopps"-areas, to see whether they could be suitably reserved for Crown forests. A Royal ordinance of December 21, 1865, ordered a similar procedure to be adopted with reference to the undelimited forests in the Län of Kopparberg and in the Norrland Läns, for the sake of increasing the area of Crown forests; by the same decree, settlements were forbidden for the time being, not only on the remaining State grounds but also in the undelimited forests. When, by the aforesaid Royal ordinance of June 29, 1866, permission was subsequently again granted for settlements to be made on ground found unsuitable for Crown parks, the above-mentioned condition was attached. The farms formed on that basis have a total area of nearly 200 000 hectares.

The principle that had thus established itself in Swedish forest-legislation was applied with far more thoroughness in **Lappland,** where delimitation had not been introduced at this period, inasmuch as settlers would have no other right to forests than that enjoyed by the occupants of Crown-farms. Without violation of, or encroachment upon, the rights of individuals, it was ordained in § 8 of the Royal statute of May 30, 1873, concerning delimitation in the Lappland territories within the limits of the Läns of Västerbotten and Norrbotten, that farm-owners in those districts should not enjoy other rights to the woods on their farms than those of taking, without previous official survey, such timber as they might require for household needs and for fuel, and of appropriating, subsequent to official surveying and marking, for the purpose of selling, such timber in addition as can be annually felled without injury to the future preservation of the forest. During the delimitation in the parish of **Särna** and the sub-parish of Idre, both in Dalarne, homesteaders were only granted a similarly restricted right of disposal of the woods falling within the bounds of their allotments, and that in accordance with their own express agreement. In this way a very considerable section of the forests of North Sweden has been subjected to regulations ensuring system in the lumbering there. The immense importance of this will be seen



Production-areas for timber of larger and smaller dimensions.

1913.

The red line shows the boundary below which timber of small dimensions may be cut.

(See text).

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more clearly, when it is remembered that the situation of these forests in the immediate neighbourhood of the Scandinavian Alps renders their preservation invaluable, as a protection against over-severity of climate.

Respecting the legislative measures adopted for private forests in other parts of the country, mention must first be made of certain local laws. Among these is the Royal Ordinance of September 10, 1869, respecting the measures to be taken for preventing the destruction of the woods on the island of **Gottland;** this was renewed by a law dated March 30, 1894, and, finally, was replaced by an enactment dated June 13, 1908, concerning the care of private woods in the island mentioned. This law, which in 1913 was also extended to the island of **Öland,** differs from the general forest law by the presence of a paragraph making it necessary to have the permission of the Forest Conservation Board before timber can be cut for any other purpose than to supply household needs, or in order to convert timbered land into gardens, arable land or pastures, or into building sites.

A purely "dimension" law has been enacted for the coast districts of the Läns of **Västerbotten and Norrbotten.** Originally it was issued only for the littoral of Norrbotten Län, in 1874, but in 1882 it was enacted that the law in question should be enforced in those parts of Västerbotten Län which did not form part of the Lappland districts. By a Royal Ordinance, dated March 19, 1888, these two enactments, with a few alterations of lesser importance, were formed into one act, which was repealed in favour of the Royal Ordinance of July 24, 1903.

This enactment forbids the shipping and the sawing at export saw-mills and the employment for the purpose of manufacturing wood-pulp, of pine- or spruce timber which, at a height of 4·75 meters from the base, does not measure at least 21 centimeters in diameter, the bark not included. The penalty for the infringement of this regulation is the confiscation of the timber. Such a law, directed as it is against a special form of mismanagement of forests, can easily become a hindrance to the proper care of the timber, which, in many places, requires the removal of second-rate wood in order that space may be secured for the growth of healthy young trees. The law does not overlook this fact, however, as it instructs the owner of timber of a character that requires the felling of second-rate trees, so as to promote the proper growth of the healthy timber, if he wishes to ship or saw such secondary wood, to apply to the proper forest-ranger, who will then make such a survey of the forest as circumstances may require. Should the proposed thinning out be found in accordance with the requirements of good forest-economy, the official in question has the power to select and stamp the second-rate timber, and to give permission for its felling.

In order to promote a rational care of the forests, the enactment has also been made that the above-mentioned survey of secondary timber shall be carried out free of expense to the owner, on condition that the forest is arranged in sections for the purpose of being cut in proper rotation and in accordance with a plan approved of by the Forest Service, and that the survey deals with timber which, according to the said plan, is destined for immediate cutting.

A law respecting "*protective forests*" was issued on July 24, 1903, for the permanent retention of forests, the existence of which is requisite

as a protection against drifting sand, or against the lowering of the tree-limit. After proper investigations, such forests have been set apart in the Läns of Jämtland, Västernorrland, and Kopparberg.[1] The law enjoins that timber-felling for other than domestic requirements may take place only after a survey, which is made by the Forest Service, at the cost of the State, when the owner of the forest is entitled to have such a number of trees marked at once as is conformable with the re-growth of the forest, and its permanent survival. Should it be necessary to make great restrictions in the right of the owner to make use of the forest, special regulations in the matter must be made; if the owner would rather sell the forest than submit to such restrictions, the State can expropriate the land. This last-mentioned regulation has not yet been put into force.

The *other private forests in Sweden* are subject to the regulations of the law dated July 24, 1903, respecting the care of private forests. According to this law, in forests belonging to private persons, lumbering must not be carried on in such a way, nor, subsequent to lumbering-operations, may the ground be so treated, as to clearly endanger the re-growth of the timber. If there has been such mismanagement of the forest, the guilty person is obliged to take the steps necessary to secure re-growth. If the lumbering rights have been made over by the owner of the forest to another person, and the latter has been guilty of the above-mentioned mismanagement, the owner is responsible for the necessary restorative measures being taken. The burden of seeing that the law in question is properly carried out rests on the Forest Conservation Board, which must exist in every county council district where the law is in force, and on the officials and inspectors of the said Forest Conservation Board, as well as on the Forest Conservation Committees appointed by communes affected.

The work of the Forest Conservation Boards is regulated in other respects by the Royal Ordinance of July 24, 1903, respecting the Board mentioned. Besides being entrusted with the task of seeing that the laws dealing with the public forests are carried out, the said Boards have also to promote the proper economy of the private forests by spreading a knowledge of forestry, by making grants in aid of, and carrying out, the work of forest-culture, by supplying seed and plants, and by taking other measures calculated to promote improved forest economy. In addition, the said Boards are entrusted with the administration of the Forest Conservation funds obtained from fees received in the course of their duties, or in any other way.

The first Ordinance respecting *Forest Conservation fees* was issued on July 24, 1903; it was altered in 1908 and 1910, and appeared in a new form on October 11, 1912. These fees are calculated on the same principles as those adopted for the forest-excise, but are fixed at an

[1] In addition to a drift-sand field in the island of Gottland.

amount equal to 1·3 % of the value of the standing timber. In the Läns of Västerbotten and Norrbotten, in the parish of Särna, and in the subparish of Idre, no Forest Conservation fees are paid and the same districts are not under the Forest Conservation Board.

The accompanying map shows the districts affected by the existing forest-laws, viz., the *"Lappmark" law,* or the regulations governing the private forests in Lappmarken and in the parish of Särna, with Idre subparish, in Dalarne; the *"protective forests" law;* the *"dimension" law* the *"Gottland and Öland" law,* and the *"public forests" law.* In all the districts affected there are public forests, for which special laws are in force.

The Swedish **Forest Service** dates its origin from a *Venery Service* established as early as the 16th century. The "deer and bird huntsmen" and the "rangers and keepers" mentioned at a still earlier date did not form a regular corps. The principal work, too, of the Venery Service, until the beginning of the 19th century, was connected with hunting, although in the middle of the 17th century, some attention seems to have been paid to forest economy. On behalf of *forestry,* however, the Venery Service did not do very much, until, after the founding of the Institute of Forestry in 1828, the officials were given an opportunity of gathering special information respecting the science. After the institution of the Board of Forestry in 1859, the head of the new department became the head of the Forest-and Venery Services as well.

For the purpose of uniting in one central department the administration, not only of the forests but also of the landed property of the State, the Forest Board was transformed in 1883 into the now-existing *Crown Lands Board,* the head of which, consequently, is now the head of the Forest Service, too. The task of this Board is, in the first place, the care and administration of the public forests. The care and improvement of game has become a matter of subordinate importance, although it is still included among the tasks of the Forest Service. The titles of the officials are Chief Foresters and Foresters (överjägmästare och jägmästare).

According to the regulations which came into force at the beginning of 1909, the Forest Service consists of 10 *Chief Foresters* and 90 *Foresters.* The number of the latter officials has since been increased and, at the close of 1913, amounted to 97. According to the same regulations, the number of *rangers* (kronojägare) was increased to 417. The service-territory under the superintendence of a chief forester is termed a *district;* that of the forester is called a *"revir"*, and that of a ranger a *"guarding-section".*

The assistant forest-officials consist of *assistant foresters* and *assistant rangers.* The total number of assistant officials in the Forest Service amounted at the close of 1913 to respectively 153 and 294, a good deal of whom had other, private employment as well.

In addition to the officials above-mentioned, there are 3 State *Forest-Engineers* employed in the Forest Service. They are entrusted with the execution of forestry matters for private owners in those parts of the country where there are no Forest Conservation Boards. The forest-engineers are paid by the State, but they also receive fees from the private forest owners who have called for their assistance. The work of the forest-engineers consists of forest-cultivation, draining of boggy woodland, the arrangement of thinning operations, and other forestry work, the giving of instruction in forest economy at agricultural schools, etc.

In those parts of the country where there are Forest Conservation Boards, the owners of private forests can obtain the assistance of those officials of the bodies in question termed "*county foresters*" and "*assistant county foresters*", who, as a rule, are also assistant foresters. There are, altogether, in Sweden, 23 county foresters, one on each Forest Conservation Board. Assistant county foresters have been appointed only in such county revenue districts where the duties of the county forester are so great as to require such additional help.

During recent years, several committees have been at work on proposals partly for the regulating of existing forest-law, and partly for the re-organization of the State forest-system. Important changes in these matters are therefore imminent.

The Forestry Experimental Service.

It was not before the beginning of the present century that a more definite form was given to the Forest Experimental Service in Sweden. On May 9, 1902, there were promulgated the statutes for the *Forestry Experimental Establishment*, which, on December 18, 1908, were replaced by Instructions for the **State Forestry Experimental Establishment** (Statens skogsförsöksanstalt).

The Experimental Service, in the year 1912, was re-organized in accordance with the existing statutes, which date from October 25, 1912 (in force from 1913). In 1913, the grant for the Experimental Service amounted to 47 100 kr., while for 1915 it is 62 200 kr. The direction of the Establishment is at present in the hands of a special Board consisting of the head of the Crown Lands Board — who is, ex officio, a member of the first-named Board — and four members who are appointed for fixed period by the Government. The Establishment embraces two sections, viz., a *forest-section* for the care and assessment of the forests, and a *scientific* section for the study of forest botany, the theory of soils, and forest entomology. Each of these sections is under a Principal, who has the title of Professor, and who is aided by a number of officials and assistants. The Government appoints one of these principals to act as the head of the Establishment for a period of three years.

The object of the Establishment is the solution of problems which are

of fundamental importance for the economy of the forests of Sweden. The work embraces investigations respecting the species and diseases of forest trees, injurious insects, the various methods of sylviculture, the rotations suitable, the conditions governing the economic returns of the forests, etc.

For the purpose of carrying out investigations and experiments in the above-mentioned respects, experimental areas are chosen by the Establishment in various parts of the country, chiefly in forests belonging to the Crown, although such experimental areas can, on certain conditions, be selected in private forests, too, should the owners desire this to be done.

During the short period during which it has existed, the Experimental Establishment has succeeded in carrying out some very thorough work, the results of which, consequently, are worthy of much attention. An account of these labours and their results is given in the Reports of the State Forestry Experimental Establishment, which have appeared annually since 1904 inclusive.

Instruction in Forestry.

Until quite lately, the State establishments for giving instruction in forestry have consisted of the **Institute of Forestry,** — which, since its establishment in 1828, has had the task of training administrative officials, foresters — and the **Schools of Forersty,** two of which were intended to train pupils for entrance to the Institute, while the others were for the training of rangers. The Riksdag of 1912, however, decided that the Institute of Forestry should be transformed into a *High School of Forestry,* at which a higher course of instruction in the science could be given, corresponding to that imparted at the universities and other High Schools. One feature of this reorganization was that the two preparatory schools of forestry were to be closed, their work now having to be carried out in a so-called "*Preparatory Course*". In addition to this, a "*Lower Course*" was arranged at the High School of Forestry, corresponding to that formerly existing at the Institute of Forestry, and intended for the training of forest officials in private service. The remaining schools of forestry remained unaltered. It is calculated that this reorganization of the system of training in forestry will be completed by the year 1915.

A fairly large site at Norra Djurgården, just outside Stockholm, has been assigned for the buildings of the High School of Forestry, in addition to which there is an experimental park attached to the establishment. The requirements for admission to the High School in question are, that the candidate shall have passed his matriculation examination in the "modern" (or science) line, while, from those that have matriculated in the classical line, there will be required a complementary examination in Mathematics, Physics, and Chemistry, corresponding to the tests in these subjects in the modern line. In addition to this, the candidate must have passed through the above-mentioned *preparatory course*, which lasts about 9 months and consists, chiefly, of practical forestry work in Norrland and in Central Sweden. To this course 40 students can gain admission every year, but of these there are chosen

25 for admission to the High School of Forestry. This preparatory course is under the direction of a *chief assistant*, aided by a number of other assistants, in addition to which, short courses of practical instruction are given to the pupils taking part in the course, by the teachers in pure forestry who are engaged at the High School.

The instruction given at the High School is both theoretical and practical. The theoretical instruction is imparted in the form of lectures illustrated by exercises in the class-room, given every year during an autumn term ($^{15}/_{10}$—$^{20}/_{12}$) and a spring term ($^{1}/_{2}$—$^{1}/_{5}$). In addition to this, a certain time is devoted to oral examinations. The practical instruction goes on during the period $^{10}/_{5}$—$^{30}/_{8}$, in forests specially devoted to the purpose in various parts of the country; during this time, the pupils have to manage the work and make the calculations connected with the different branches of the management of forests. Besides this, journeys are made under the direction of the teachers to various parts of the country, for the study of forest management, the transport of timber from the woods, floating, and timber manufacturing works. A full course of study at the High School embraces 3 autumn terms, 2 spring terms, and 2 summer terms. Twenty-five pupils are admitted to the High School each year.

The High School is under the superintendence of a Board of Governors numbering 5 persons, the President of the Crown Lands Board being ex. officio one of these members. The teaching staff consists of 4 professors in the subjects of Forest Management, Forest Mathematics, Forest Technology, and Forest Botany, each with an institute and collections, in addition to whom there are teachers in the following subjects: Forest Zoology, the Science of Soils, Forest Policy, General Legislation, the Forest- and Game Laws, Bookkeeping, Technical Chemistry and Agricultural Economy. One of the Professors acts as the Rector of the High School, and is assigned the task of laying its business before the Governors.

Pupils that have passed in all the subjects at the final examination at the end of their course at the High School can be appointed as Extra Foresters in the service of the State.

The *Lower Course* given in connection with the work of the High School will embrace a training period of about $1^{1}/_{2}$ years. The requirements for admission to this course are, to have passed the "Realskolexamen" (Modern School) and to have had at least 22 months' practical work in Forestry. 12 pupils are admitted to this Course each year.

The State *Schools of Forestry* are 7 in number, and are situated in various parts of the country. Each is under the superintendence of a *Director*, who is also the head-master of the school, and has an *assistant*. Each school has been assigned a large tract of forest-land which is managed by the Director. The period of training lasts from $^{1}/_{11}$ to $^{15}/_{10}$ of the following year. The instruction is directed mainly to giving the pupils practical skill in the more important branches of forestry and exercise in the direction of such work, but it also embraces theoretical studies in the fundamental principles of Forest Economy. The number of pupils at each school is, as a rule, 20, who enjoy instruction gratis, and are provided with rooms free of cost, but have to pay for their board themselves. Pupils without means can be awarded bursaries, each amounting to 250 kronor. For entrance to the schools of forestry the candidate must: have a knowledge of the subjects taught at the elementary schools, enjoy good health, and be not less than 20 and not more than 30 years of age.

In addition to the above-mentioned State institutions for imparting instruction in forestry, instruction in forest economy is given at the Agricultural Schools and the Agricultural High Schools too; at special schools of forestry

and charcoal-burning, established on private initiative, and also at People's High Schools, and Farmers' Schools. A most extensive work of disseminating instruction and information concerning the rearing and care of timber and forests is also carried on by the Forest Conservation Boards of the various läns, by means of the so-called courses in Forest Culture, intended for the peasantry, by means of lectures, and, finally, by setting apart certain days on which the children in the elementary schools go out to plant trees.

2. FOREST INDUSTRIES.

Even when the population of Sweden first began to enter into more lively commercial relations with other nations, it would appear that forest products formed a considerable part of Swedish exports, although at first the demand mostly comprised other forest products than those which are now the most important.

From various documents dating from the Middle Ages we find that furs and hides of different forest animals (elk or moose, deer, etc.) were in great demand as articles of commerce and were bought in the Swedish ports by foreign traders. The **Hanseatic cities,** which, at the close of the Middle Ages, controlled the commerce and navigation of Northern Europe, took from Sweden their requisite supplies of pitch, tar, masts, and spars, as well as, to a certain extent, of firewood, deals, and boards. The boards exported went by the name of hewn boards, i. e., not sawn, but hewn by the axe direct from the log.

In early modern times the **Dutch** inherited the commercial supremacy of the Hanseatic cities in the North and also became the principal purchasers of Swedish timber. As they were in need of much timber for their great commercial and naval fleets as well as for dams, piles for building purposes, etc., which could not be obtained in their country, so deficient in forests, the Swedish export of timber to Holland became very extensive for those times. The timber shipped consisted principally of masts, spars and balks, hewn by hand, and logs, which were afterwards sawn in the numerous wind saw-mills in Holland. — During the eighteenth century, the position as the head of the world's commerce and shipping passed from Holland to **England,** which country, for nearly the same reasons as Holland, found it necessary to import timber.

In order to give an idea of the extent of the Swedish timber-trade at the beginning of the nineteenth century, it may be mentioned that, in the year 1809, Sweden exported about 220 000 dozen boards and deals, about two-thirds of which went to England. The whole timber export was then estimated at a value of 5 488 000 kronor, which equalled one-seventh of the total export of the kingdom at that time.

During the wars against Napoleon, the development of the timber trade was arrested. For in 1809 England imposed — chiefly as a retaliatory measure against Napoleon's system of isolation — a very considerable increase of the former import-duties on timber from the Continent, which increase was further raised the following year and rose once more in 1813, so that the import-duty per load (1·42 cubic meters) thus finally amounted to £. 3. 5 sh. These customs-duties had all the greater effect on the European exports to England, as, at the same time, only an inconsiderable duty was paid on the timber imported from British North America. Consequently, commerce between Sweden and

Marking Trees for Felling.

England greatly declined. It is true that, in 1821, after the termination of these wars, the English customs-duties on timber were lowered to £. 2. 15 sh. per load, while at the same time a duty of 10 sh. was imposed on American timber. The difference was, however, still large enough almost entirely to exclude European timber from English ports. It is even said that sometimes

such timber would first be transported across the Atlantic and then, benefiting by the said privilege as to duty, be finally re-shipped to some English port. That any direct importation of Swedish timber could take place at all was due alone to the fact that the latter was more highly valued than the American product.

Finally, a change of opinion took place in England, when that country's need of timber for different industrial purposes became considerably greater. Considerable reductions were made in the custom-duty on timber in 1842 and 1851. This duty was further reduced again in 1860, so that it only amounted to one or two shillings per load, and at last it was entirely abolished in 1866. With this measure the Swedish timber export gained a market sufficiently extensive to create in Sweden a real timber industry. The foreign market for Swedish timber was also increased by the commercial treaty with France of 1865, whereby various forest-products imported from Sweden, among which were boards and deals, were relieved from the former custom-duties.

At the same time the *commercial legislation of Sweden* underwent important changes. During the eighteenth century, sundry restrictions had been in force both in regard to the foreign timber trade and to commerce generally within the kingdom. Thus, e. g., for boards sent to Stockholm certain dimensions were stipulated by law. These regulations, obstructive to free commerce, were gradually abolished during the first half of the nineteenth century (more particularly so by the General Commercial Regulations of 1846). Export-duties had formerly been imposed on many different kinds of timber, such as rough, sawn, or hewn timber of most kinds of hard wood, unhewn red wood and white wood, and small beams and rafters, while boards and deals of red wood or white wood went free of duty. Most of these export-duties were removed in 1857 and ceased entirely on the introduction of the customs' tariff of 1863.

As the foreign demand was principally for sawn timber, the **Saw-mill industry** in Sweden was given a new importance. It is not known with certainty when the first saw-mills were erected in our country; this may possibly have been done as far back as the Middle Ages. It is certain, however, both that there have been water-power saw-mills in use in this country for several centuries and, on the other hand, that it was not until during the nineteenth century that the saw-mill industry became a genuine branch of trade. The initiative was taken by some prominent Gothenburg merchants, some of whom were of British birth and, through their connections, familiar with the steadily increasing demands of English industries for wood. In the decennium 1841—50 vast forests were bought, first in Värmland and Dalsland, afterwards in Norrland, and large water-mills with several saw-frames were built. These saw-mills were mostly situated by some water-fall in proximity to the coast, but the fact that they could not be built close to the sea-shore proved a disadvantage; for, before the sawn timber could be shipped, it had either to be carted overland or towed in barges to the sea-port, which was rather expensive, or else it had to be floated, which, on the other hand, caused a deterioration in the appearance and quality of the timber. In this respect, the establishment of *steam saw-mills on the sea-coast* produced a complete revolution, whereby essential advantages were gained. By locating the saw-mills on the coast, the former long transport of the timber from the saw-mill to the port was saved; further more, the use of steam-power in the saw-mills brought about a greater productive capacity, finer product, and freedom from the obstacles to the steady run of the works arising from ice in winter and lack of water in summer. The first steam saw-mill in Sweden was built in 1851 at Vivsta, near Sundsvall; next in order were Sandö and Kramfors, both in Ångermanland (1852). During the years 1851—60 and especially during 1861—70, the number of steam saw-mills

TABLE 33. *Exports of Wood-wares (all kinds) from the most important wood-exporting countries.* Values in thousands of kronor.

Country	Year 1906	Year 1907	Year 1908	Year 1909	Year 1910	Annually 1906—10	Year 1911
Sweden	236 465	244 484	217 474	212 784	264 736	235 189	274 138
Norway	79 709	81 858	75 311	73 512	79 490	77 976	78 059
Finland	109 154	110 659	101 964	108 011	125 056	110 969	131 458
Russia	187 776	206 360	213 064	242 579	264 250	222 806	271 851
Austria-Hungary	253 006	273 065	233 634	225 289	245 795	246 158	269 180
U. S. A.[1]	257 670	310 894	304 074	253 146	293 975	283 952	344 115
Canada[1]	189 165	183 070	166 571	199 638	193 980	186 485	172 756

[1] For Canada and the U. S. A. the mercantile years given do not coincide with the calendar years.

grew rapidly. The timber industry was also greatly promoted by the growth and development in Sweden of commercial companies, thanks to the law of 1848 regarding joint-stock companies, by which measure the co-operation of several persons for the purpose of establishing large industrial enterprises was facilitated.

We may add to this the enormous improvements the *means of communication* underwent. Formerly the shipping of Norrland timber was performed principally by sailing vessels from that part of the country, which could make at most only two trips a year to the ports of destination in England and France; a voyage to the Mediterranean and back took a whole year. The freight to England might then amount to £4½ per standard. Since steamships have begun to be used in the timber trade, and, consequently, the voyages altogether have become more rapid, the cost of transport has considerably decreased. The re-building of the Trollhätte Canal (1838—44) was a very great advantage to the export via Gothenburg, and finally we only need to point out the revolution in the transport system which has been brought about by the railways.

The saw-mills, when first established, had but little difficulty in getting their necessary *supply of timber*. Although only the largest and soundest redwood timber was cut, and all unsound inferior timber and white wood, together with no inconsiderable proportion of the top-logs were left, still it was not necessary to penetrate far into the forest from the sea or the great rivers in order to get a sufficient amount of raw material. But, with the constantly increasing demand from abroad and the increase in the number of steam saw-mills, this state of things soon changed. The easily accessible, heavy timber nearest to the watercourses began to be exhausted, and it became necessary to select the raw material from the upper courses of the rivers. At the same time it began to pay to make use of both white wood and poorer red wood and timber of smaller dimensions, which had hitherto been despised and left in the forest.

For rather more than two decades from the founding of the first steam saw-mills, the saw-mill industry in Norrland continued, under the favourable conditions to expand, and there poured in a regular stream of native and foreign speculators, and of workmen from the southern part of the country. The workmen's wages now had risen to a very high standard, and the manner and habits of life among the floating population of workmen were, too, in accord with that standard, but, as long as the prices of timber continued to rise, everything ran smoothly. In 1874, however, a turning-point was reached, the foreign market beginning to fluctuate, and the prices, after having once more risen somewhat in 1877, sank the next year at a breakneck speed. The average price of sawn timber in Sunds-

vall, which, in 1874, was up to 170 kronor per standard (4·672 cubic meters), fell in 1879 to 76 kronor. A serious commercial crisis followed. In one respect, however, it brought about a good result, by clearing the timber trade from a considerable amount of unsound elements; from persons whose only purpose was to make a fortune as rapidly and with as little work as possible, without the slightest heed to the future stability of the industry or to the future of their workmen. For the men of better character engaged in this industry, the hard years brought with them many wholesome lessons; they learned to neutralize the fall in prices by more carefully utilizing the standing timber, by employing cheaper methods of work at the mills, by a more perfected working up of the timber, and a more thorough utilization of the waste wood which had formerly been considered worthless. The prices of timber have since then undergone many fluctuations, but none so violent as those just mentioned. This matter will be referred to further on.

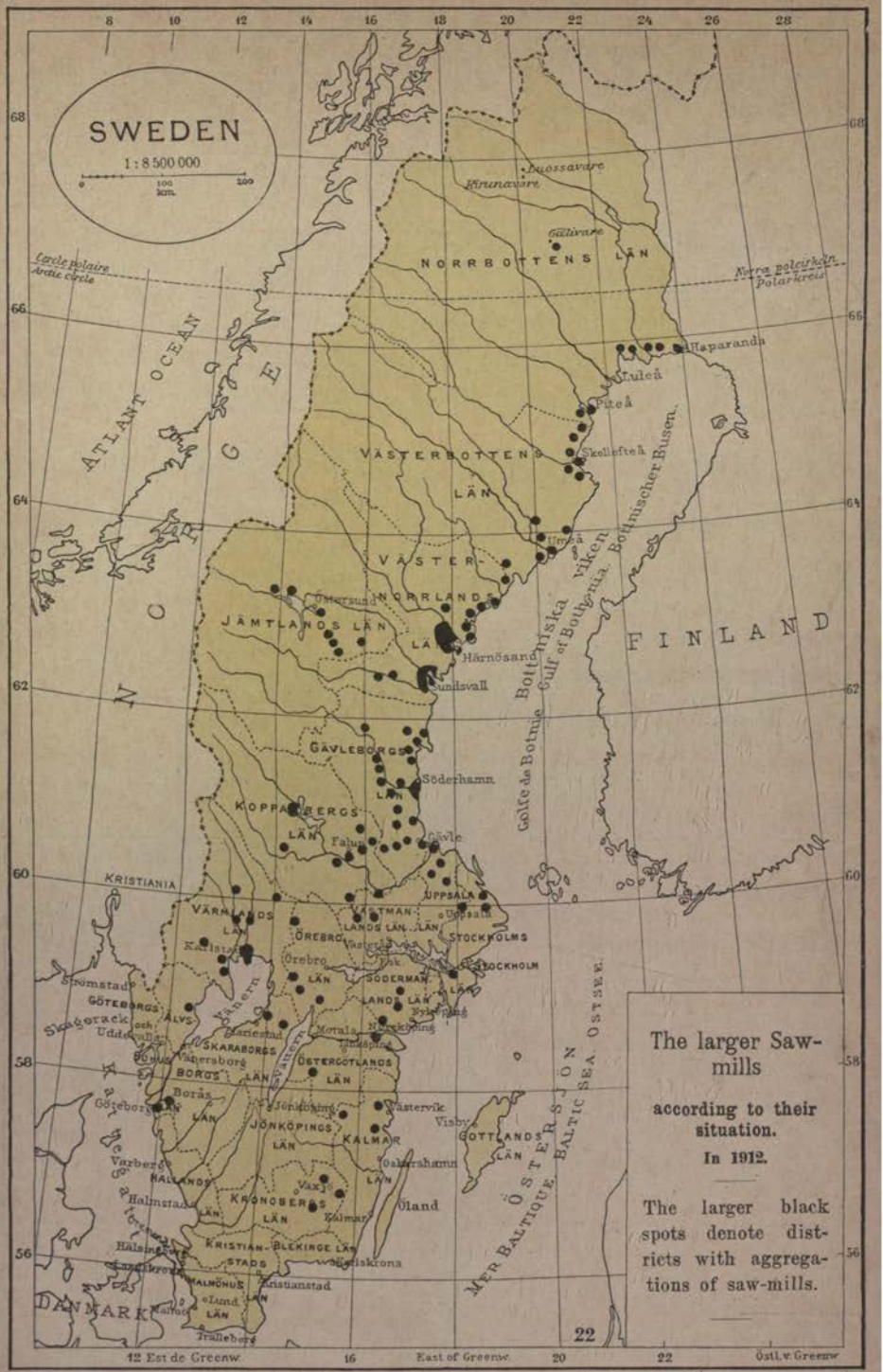
In order to illustrate the *growth* of the saw-mill industry, a few figures may here be given. In 1821 (the same year that the first reduction of customs-duties in England took place), Sweden had 3 633 saw-mills with an output of 267 000 dozen deals and boards, about 200 000 dozen of which were exported. Forty years later, our country owned 59 steam saw-mills and 4 933 water or wind saw-mills, and the export of deals and boards alone amounted to 1 478 000 dozen. After the lapse of fifteen years more, this export had been trebled again, and the total export of all classes of rough timber rose to a value of upwards of 100 million kronor, and at present the value of the total timber export has attained the figure of 300 million kronor (in 1912).

As shown by Table 34, below, timber-goods play an extraordinarily important role in the **foreign trade** of Sweden, as far as *exports* are concerned.

TABLE 34. *Sweden's Imports and Exports of Timber (unwrought and wrought).*

Annually	*Imports.* Thousands of Kronor			*Exports.* Thousands of Kronor			In % of the whole	
	Unwrought and hewn	Sawn and more or less wrought[1]	Total	Unwrought and hewn	Sawn and more or less wrought[1]	Total	Imports[2]	Exports[2]
1871—75 . . .	754	983	**1 737**	16 444	74 734	**91 178**	0·71	44·58
1876—80 . . .	724	1 248	**1 972**	15 476	83 428	**98 904**	0·73	47·13
1881—85 . . .	1 486	1 849	**3 335**	15 573	94 393	**109 966**	1·05	45·12
1886—90 . . .	1 544	2 193	**3 737**	14 955	101 821	**116 776**	1·11	42·84
1891—95 . . .	1 929	2 624	**4 553**	16 933	119 786	**136 719**	1·30	42·96
1896—00 . . .	3 601	1 840	**5 441**	18 339	161 140	**179 479**	1·21	50·05
1901—05 . . .	2 747	2 114	**4 861**	19 475	180 040	**199 515**	0·91	48·67
1906—10 . . .	7 658	2 766	**10 424**	20 520	214 669	**235 189**	1·62	45·63
1909	8 043	2 439	**10 482**	19 006	193 778	**212 784**	1·70	44·99
1910	12 438	2 686	**15 124**	18 319	246 417	**264 736**	2·25	44·65
1911	11 004	4 077	**15 081**	18 711	255 427	**274 138**	2·16	41·31
1912	12 748	6 303	**19 051**	16 898	284 435	**301 333**	2·43	39·62

[1] In these figures there are included among the wrought goods both wood pulp and matches. — [2] Imports and exports of wood-goods in % of the total imports and exports of the kingdom, of all goods.



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It will thus seen that, during the last few years, timber has represented nearly *one half* of the total exports of the country. A satisfactory sign is that it is chiefly the export of more or less wrought timber that has risen; the export of unwrought or hewn timber has remained practically stationary.

In our own days Sweden occupies one of the foremost places among the timber-exporting countries of the world. This is owing to its abundant supply of timber, the facilities for getting the timber out of the forests — afforded by the winter's cover of snow and the frozen lakes and marshes — the numerous water-courses which are suitable for floating, and the excellent quality of the Swedish timber — a good heartwood and one particularly free from knots — which makes it especially suitable for joinery purposes. In comparison with certain other richly wooded countries, Sweden is also favoured by its convenient situation for shipping and its many good harbours.

Saw-Mills.

In 1912, the value of the output from saw-mills and wood-planing mills was stated to be 174 144 189 kronor, — a far higher amount than any other class of manufactures could show. The income of the trade was estamited at about 10 million kronor. The number of workmen occupied in this industry amounted to 37 908. During that year, 1813 saw-frames and 956 planing-machines were in use. As motive power, 60 waterwheels, 298 turbines, 981 steam-engines, 11 steam-turbines and 20 petroleum-, bensine- and gas-motors were employed for the mill-work proper, and 25 water-turbines, 130 steam-engines and 33 steam-turbines for running electric-motors. The whole number of electric motors is given at 1 067.

The output of the principal kinds of wood was divided among the different läns as shown by Table 35. As will be noticed, the län of Västernorrland stands easily first, with nearly 30 % of the total production of the kingdom; next in order comes the län of Gävleborg. — The total number of saw-mills and planing-mills in Sweden, of the character of genuine factories, is stated to be 1 248. The provinces situated north of the River Dalälven embrace about one-third of the saw-mills of the kingdom. Numerically, consequently, they do not preponderate, but the extent of their output is so much the greater.

Staves are sawn in the main from hard wood. As far as regards the chief kinds of sawn timber, viz., deals, battens and boards (planed and unplaned), the red wood goods come to about three-fifths of the whole, and the white wood goods to about two-fifths.

In the preceding pages, we have already referred to the strong influence that the company system has had on the development of the saw-mill industry. Among the 1 248 saw-mills and planing-mills, 526 were owned

TABLE 35. *The manufacture of the most important Wood-wares at Saw-mills and Planing-mills in 1912.* In cubic meters.

Län	Unplaned deals, battens and boards	Planed boards	Board and deal-ends	Lists and laths	Staves and handings	Fuel-wood	Total cubic meters[1]
Stockholm city	1 897	3 857	—	115	—	372	**6 241**
Stockholm län	57 520	21 551	1 719	1 512	—	18 492	**100 794**
Uppsala	194 481	29 622	11 056	2 268	6 544	25 937	**269 908**
Södermanland	60 066	24 667	1 765	511	303	25 210	**112 522**
Östergötland	108 279	33 931	1 011	977	2 046	34 067	**180 311**
Jönköping	81 275	23 639	2 153	981	441	29 535	**138 024**
Kronoberg	79 788	21 708	335	1 543	4 326	22 608	**130 308**
Kalmar	83 802	25 193	3 117	638	1 656	18 709	**133 115**
Gottland	1 150	1 327	—	160	—	377	**3 014**
Blekinge	9 344	8 755	—	456	360	3 360	**22 275**
Kristianstad	15 769	634	56	3 595	2 885	5 597	**28 536**
Malmöhus	6 730	7 723	—	688	1 839	6 540	**23 520**
Halland	11 370	5 798	—	220	572	3 668	**21 628**
Göteborg och Bohus	50 484	94 873	—	2 587	1 710	14 770	**164 424**
Älvsborg	61 960	19 181	350	1 804	1 108	24 634	**109 037**
Skaraborg	59 804	10 517	220	498	—	21 132	**92 171**
Värmland	324 195	29 722	6 776	2 960	4 681	76 636	**444 970**
Örebro	117 931	16 174	1 471	2 805	978	52 639	**191 998**
Västmanland	85 039	20 345	1 770	1 116	573	45 064	**153 907**
Kopparberg	307 085	118 442	7 209	4 823	5 454	27 213	**470 226**
Gävleborg	641 208	224 605	63 647	8 118	26 631	26 368	**990 577**
Västernorrland	1 384 366	261 811	174 758	28 689	59 863	150 825	**2 060 312**
Jämtland	71 517	42 779	353	1 621	15 483	7 876	**139 629**
Västerbotten	333 836	94 385	59 059	15 368	12 848	3 338	**518 834**
Norrbotten	380 748	9 839	44 564	13 738	15 960	10 833	**475 682**
The whole kingdom	**4 529 644**	**1 151 078**	**381 389**	**97 791**	**166 261**	**655 800**	**6 981 963**

[1] The figures do not include some less important kinds of goods (lath- and trellis wood, etc.), of which the statistics do not give the quantity but only the value.

by joint-stock companies (with limited liability) and 227 by other companies — thus together considerably more than half. The preponderance of the companies is, however, still greater than is shown by these figures, since nearly all the largest export saw-mills are in the hands of companies, mostly joint-stock ones.

The following survey of the **principal saw-mills** will show their situation within different parts of the country.[1]

Beginning with the northernmost län of Sweden, and omitting a few mills of minor importance in the **Haparanda** district and in its vicinity, we find in the parish of Neder-Kalix the *Båtskärsnäs* or Fortuna saw-mill. The mill is provided with 4 saw-frames, edging-benches, heading-machines, etc. and ships annually about 8 000 standards of sawn goods, besides a large quantity of charcoal etc. In the same parish at the mouth of the Kalix, lies *Karlsborg*, belonging to the Baltiska trävaruaktiebolaget, and employing 10 saw-frames, and shipping about 20 000 standards of sawn timber, inclusive of timber from the *Stensborg* saw-mills in the Luleå shipping-district, belonging to the same company. Some-

[1] Translation of some Swedish expressions. *Aktiebolag* = joint-stock company. *Bolag* = company or partnership. *Trävaru* = wood. *Såg* = saw-mill. *Sågverk* = saw-mill. *Ångsåg* = steam saw-mill.

what farther to the west lies *Törefors*, with 3 saw-frames and an annual shipment of 8 000 standards of sawn timber.

In the district of *Piteå* lie *Munksund* and *Skuthamn* (owned by the Munksund Sågverksaktiebolag), the former with 10 saw-frames and the latter with 5, and shipping altogether about 18 000 standards. Not far away lies the *Storfors* saw-mill, belonging to a joint-stock company of the same name, which also owns *Brännfors*, in the Län of Västerbotten. Its shipments probably amount to nearly 20 000 standards.

In the län of **Västerbotten** we find *Furuögrund*, owned by the Ytterstfors trävaruaktiebolag, and, in the vicinity of *Skellefteå*, the important saw-mills of *Sävenäs* and *Björnsholmen*, which are owned by the Sävenäs Nya Aktiebolag; altogether, these mills have an output of about 15 000 standards. *Bure*, belonging to the company of the same name, ships about 12 000 standards of sawn timber and 2 000 standards of planed timber. *Robertsfors* is a water (turbine-) saw-mill with 5 frames and 2 edging-benches. At the mouth of the *Umeå* lie *Holmsund* and *Sandvik*, each of them owned by a separate joint-stock company. Further south, in the parish of Nordmaling, are situated *Rundvik* (with 8 saw-frames) and the *Mo* (or Norrbyskären) *ångsåg;* the latter, which is the largest saw-mill north of the Sundsvall district, has 12 saw-frames and a planing-mill with 4 planing-machines; the shipments amount to about 20,000 standards. The establishment belongs to the Mo och Domsjö Aktiebolag.

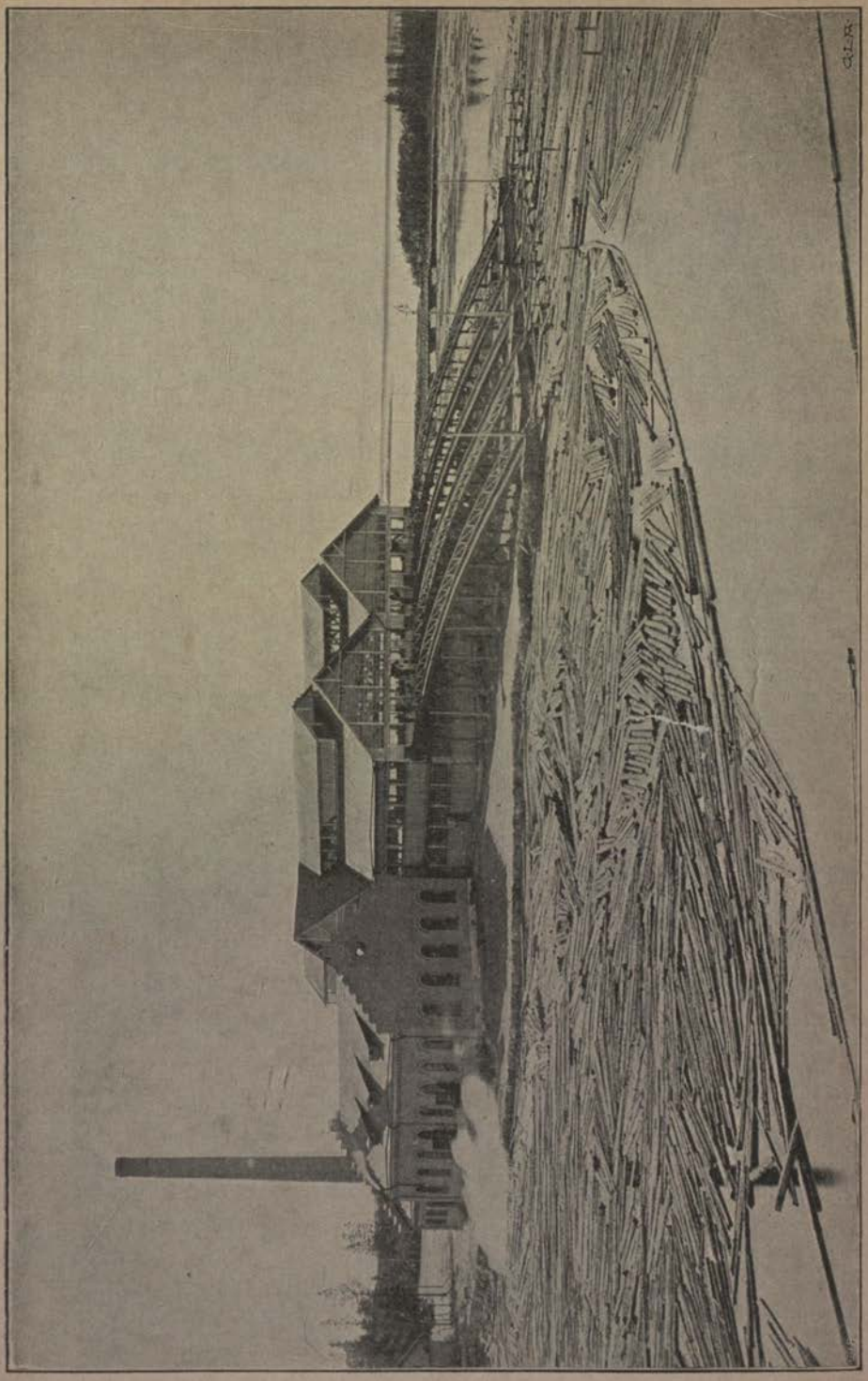
The province of **Jämtland,** being distant from the sea, has only a few saw-mills of importance. The principal ones are *Gällö* and *Trång* (or *Trångsviken*); both ship their products largely over Norway.

Västernorrland, on the other hand, is distinguished for its many big mills, only a few of which can here be mentioned. Belonging to the **Örnsköldsvik** shipping district, there are *Järved*, with 9 saw-frames, *Köpmanholmen*, and *Domsjö*, with 6 saw-frames, a planing-mill with 2 planing-machines, and a shipment of 9—10 000 standards; it is owned by the Mo och Domsjö Aktiebolag.

Along the **Ångermanälven** (the district of Härnösand) there is a big assemblage of large saw-mills. At Nyland, where the river begins to be navigable for sea-going vessels, we find the first steam saw-mills. Not far from Nyland lie *Marieberg*, *Köja*, and, on the southern bank, *Bollsta*, belonging to Graningeverkens Aktiebolag and shipping about 12 000 standards of sawn timber. Further down lie *Lugnvik* and *Hallsta; Dal*, with a large planing-mill; *Sandö* on an island in the river; *Sandviken*, *Strömnäs*, *Svanö*, also situated on an island in the river, and *Sprängsviken*, both of which latter belong to the same company, and finally, *Kramfors*, the largest in the district, with 12 saw-frames, 4 planing-machines, edging-benches and heading machines, etc.; its shipments amount to more than 20 000 standards. Near Härnösand lie *Ulvvik* and *Lörvik*, shipping altogether 13 000 standards, and in the town itself there is *Härnösands ångsåg*, belonging, as also *Björknäs*, to the Björknäs Aktiebolag, whose annual shipments are estimated at about 17 000 standards.

More important still than the Härnösand district is that of **Sundsvall** (or Medelpad), both as regards the magnitude of its shipments and, particularly, the prices obtained for the goods shipped. The principal saw-mill owners there are the Skönviks Aktiebolag, which, among other mills, run the great steam saw-mills of *Skönvik* and *Östrand* (the latter recently burnt down), each with 15 saw-frames, besides edging-machines, planing-machines, etc. The company was organized in 1861 and has had a most successful career, at the same time having devoted large amounts to experiments made for chemical and technical purposes. Its total shipments amount to about 23 000 standards of sawn or planed timber, besides fire-wood, charcoal, etc.

Vivsta varv, north of Sundsvall, is, as has already been mentioned in another



The Mo Saw-mill, Nordmaling, Angermanland.

connection, the oldest steam saw-mill in Sweden. It was founded in 1851, but has since been rebuilt and enlarged. The company which owns it has been celebrated for its dividends, which are unique in Sweden (amounting to as much as several hundred per cent per annum on the original value of the shares); in 1896 it was reorganized into a company with limited liability. The saw-mill has 12 saw-frames, 4 edging-benches and 3 planing-machines, and its shipments amount to more than 18 000 standards.

As the third in importance of the great saw-mills in this district, we should mention *Svartvik*, situated near the outlet of the River Ljungan, south of Sundsvall. It has 12 saw-frames and 5 planing-machines, etc. The shipments are estimated at about 16 000 standards, of which 6 000 standards consist of planed wood. Svartvik was formerly owned by the Dicksons, of Gothenburg, a family famous in the history of the timber trade, but it now belongs to the Trävarubolaget Svartvik (not a limited company).

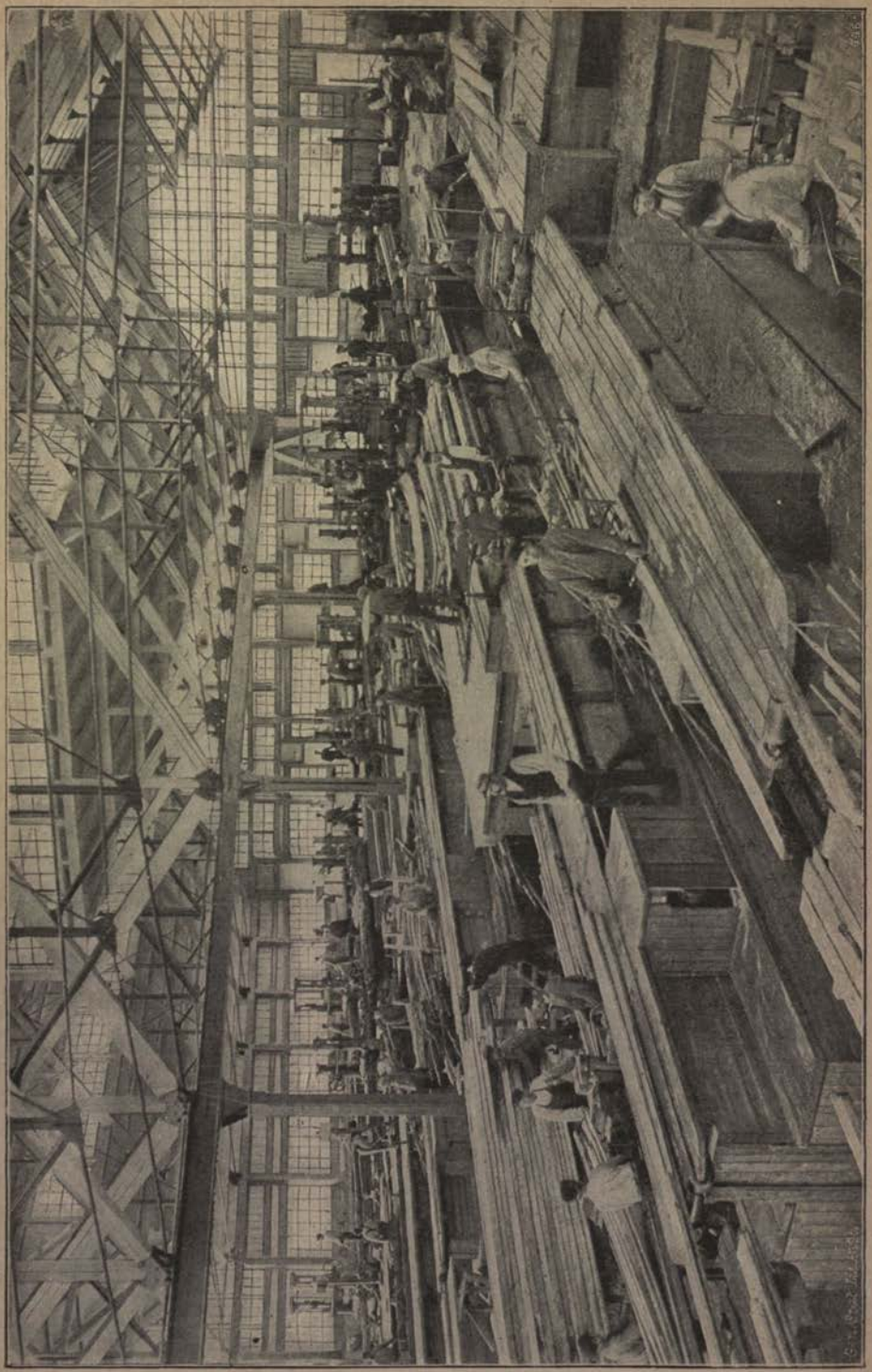
J. A. Enhörnings Trävaruaktiebolag is also one of the most important timber exporters, owning the *Kubikenborg* mill (with 8 saw-frames) south of Sundsvall, and the so-called *Heffner* steam saw-mills, north of this town. Its estimated shipments amount to 20 000 standards of sawn timber, and 5 000 standards of planed wood. Besides these, we need only mention *Mon* (the oldest and most renowned planing-mill in this district), *Sund*, *Johannedal*, *Klampenborg* and *Tunadal*, in the vicinity of Sundsvall; on Alnö island, which protects the harbour of Sundsvall from the sea-gales, lie *Karlsvik*, *Eriksdal*, *Gustavsberg*, *Nacka*, *Strand*, and *Hovvid*, and, on a small island near Alnö, is the *Hörningsholm* saw-mill.

If we next pass on to Hälsingland, we find in the vicinity of **Hudiksvall** the three steam saw-mills *Bergsjö*, *Saltvik*, and *Håstaholmen*, and further inland, *Hybo*, all of which belong to the Hudiksvalls trävaruaktiebolag. Of their products, about 30 000 standards, a large proportion (about 8 000 standards) is sold after being converted into planed wood. Further, we may mention *Stocka*.

In the **Söderhamn** district lie *Ala* and *Bergvik*, belonging to a large joint-stock company partly working with English capital. Their combined shipments amount to about 10 000 standards of sawn goods and 50 000 railway sleepers. The *Sandarne* planing-mill and the *Askesta* steam saw-mill, which is connected with Sandarne by a short railway, are now owned by Sandarne Aktiebolag, in which the above-mentioned Bergvik och Ala Nya Aktiebolag have a controlling interest; the shipments are estimated at 12 000 standards of sawn and 5 000 standards of planed wood. Near Askesta lies *Marma*, *Källskär*, *Långrör*, *Åsbacka;* and further inland, *Kilafors* and *Lottefors*.

The **Gävle** district, with regard to the export of sawn timber, is not far behind the Sundsvall and Härnösand districts. The two biggest saw-mills in Europe belong to the Gävle district. One of these is the magnificent establishment of the Korsnäs Sågverksaktiebolag, (30 saw-frames), situated at Bomhusvarvet (Kastet) and Lövharsudden just outside Gävle, having been removed some few decades ago to its present site from Korsnäs in Dalarne (whence its name). The other is *Skutskär* in the Län of Uppsala; (24 saw-frames), which resembles an entire town and has a very good harbour. Both mills are connected with the Dalälven by long canals for floating timber. The amount stated as shipped from each place is above 40 000 standards.

Skutskär belongs to the Stora Kopparbergs Bergslags Aktiebolag, which also owns *Domnarvet* in **Dalarne** and some smaller saw-mills. Domnarvet is principally an iron-works, but its saw-mill, which is driven partly by water-power and partly by electric-power supplied by a neighbouring waterfall, is of fairly great importance (9 saw-frames) and is large enough to employ about 200 workmen. Further, we may mention Kopparbergs och Hofors Sågverks Aktiebolag,



Interior of the Mo Saw-mill.

which owns *Norrsundet* in **Gästrikland,** as well as *Näs* and *Linghed* in Dalarne. *Runn* saw-mills and the *Siljan* saw-mills lie close to the lakes of the same name.

Most of the other exporting saw-mills in Dalarne have Gothenburg for their shipping port. Generally the timber is transported by rail to Kristinehamn on Lake Vänern and from there in covered lighters to Gothenburg. Among these saw-mills, we may here mention *Vansbro*, *Mora*, and *Saxviken*. The exports from the majority of the saw-mills in **Värmland** and **Dalsland** also go via Gothenburg; but some send their wood over Norway, and some others via Uddevalla. Among the saw-mills of Värmland the most notable are the *Karlstad* saw-mills, *Orrholmen* and *Bergholmen*, both near Karlstad, *Munkfors* (belonging to the Uddeholms Aktiebolag), situated farther up the Klarälven, and *Rämen*.

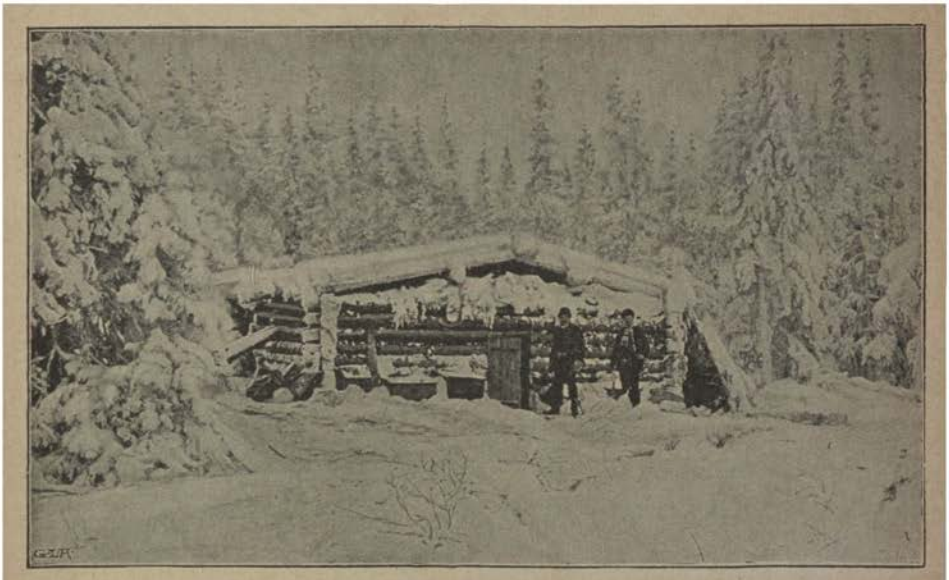
The South of Sweden is, with respect to the saw-mill industry, far behind the provinces previously enumerated. It is true that the saw-mills in this part of the country, and especially in the Småland highlands, are very numerous, being found here even in greater numbers than in Norrland, but they are mostly small — sometimes consisting only of movable locomobile saws — adapted to the supply of local needs, and contribute but small quantities for export. A few of them, however, do business on a scale which approaches that of the Norrland trade. Such are *Hellefors*, on the river Svartälven in the Län of Örebro, *Sparreholm* in Södermanland, *Norrköping* export planing-mills, *Blankaholm* in Kalmar Län, and *Lessebo* in Kronoberg Län. The saw-mills of **Gothenburg** and its vicinity deserve special notice, such as the steam saw-mills belonging to the joint-stock companies of Bark & Warburg, F. O. Strömman & Larsson, Niels Torelius, Färjenäs and the Säveåns aktiebolag; they are all connected with joinery works, however, and therefore more correctly come under the woodmanufacturing industry.

Timber Cutting.

In order to obtain the necessary **raw material** for his produce, there are several different courses available for the saw-mill owner. He can either purchase forest-land with full rights of ownership; or else only lease the right of cutting timber for a certain term over a certain forest area; or buy the trees marked with the crown stamp from Crown lands; or finally, buy timber from owners of private forests.

In the "good old times", about two hundred years ago, everyone was permitted to cut timber (for sawing) in the extensive Crown forests of Värmland, Dalarne, and Norrland. During the eighteenth century this privilege, it is true, was somewhat restricted, but, nevertheless, the Crown still very generously granted privileges for the establishment of saw-mills, with a right to fell timber in the Crown forests, a privilege which was called "**Stockfångst**" (see p. 168). Most frequently this "stockfångst" was restricted to a certain quantity, and sometimes reservations were made protecting the exclusive right of the State to mast-trees or the like. To begin with, the taxes imposed on the saw-mill industry also included the payment for the forest products thus used, but later on a separate charge was levied on such products, under the name of "stubböresavgift" (stumpage). This charge was, however, very low, varying from $^1/_2$ d. to 2 $^1/_2$ d. per tree; sometimes it was payable in kind, as in the case of a saw-mill in Västerbotten, where the stumpage for the privilege of felling 1 200 trees annually was to consist in the delivery of 37 $^1/_2$ dozen plain red boards and 6 $^1/_4$ dozen ship-deals. After 1820, these grants of privileges ceased, and of late years, from 1870, the Government has endeavoured to abolish them altogether by offering the pri-

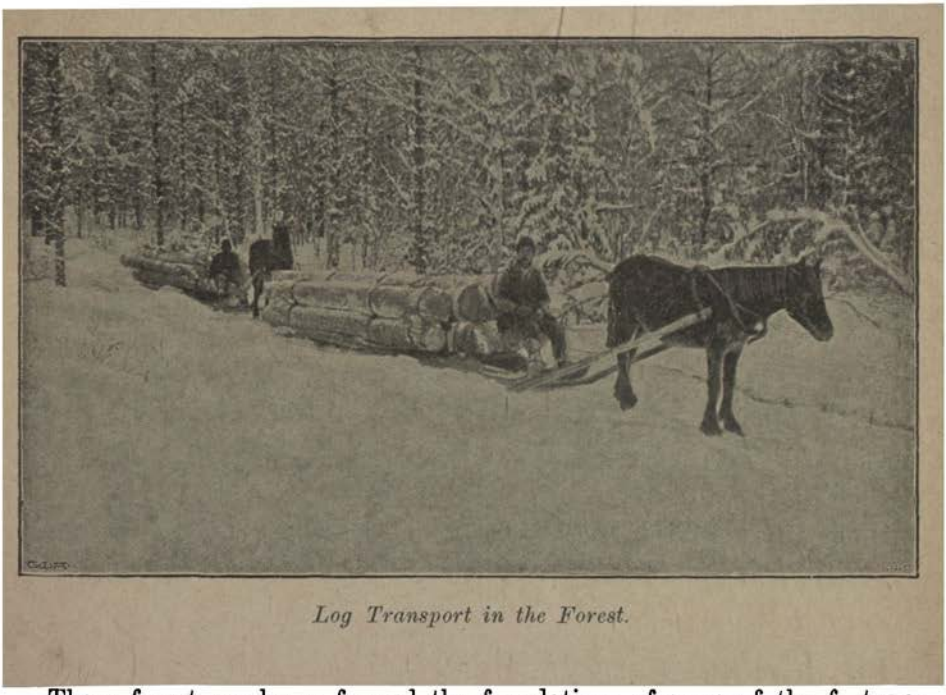
vileged saw-mills the right to cut a *larger* quantity of timber in the Crown forests during a certain *limited* period, on condition that their old privilege shall cease at the expiration of this term, and, consequently, only a few of these privileged saw-mills still exist in the northernmost läns.



Log-cabin for Lumber-men.

When the great, modern saw-mills were erected, the leading men of the timber trade soon recognized the fact that the value of the forests would be considerably enhanced if floating-costs were lowered (i. e., by regulating the water-courses) and by the introduction of improved methods of work at the saw-mills, and they consequently directed their attention to securing such supplies of timber as seemed necessary, through **contracting with private individuals.** For this purpose, contracts were entered into with private landowners or village communities, giving the saw-mill owners the right to cut timber in their forests, either unconditionally or with certain restrictions. The terms of these concessions varied. By the legislation then in force, the valid duration of these compacts was limited to 50 years at the most, and this was also the term most frequently stipulated in these contracts; but sometimes they were only to be valid for one decennium or more. The right of felling was sometimes altogether unconditional, at other times restricted to trees of certain dimensions varying between 7 inches in diameter, at a height of fifteen feet, and 10 inches at a height of 20 feet; sometimes white fir was reserved from cutting at a time when this kind of timber was still considered as of very little value. No doubt these regulations have caused some confusion in certain cases. The liquidation of these timber-purchases was generally made by payment of a lump-sum for

the whole term of contract; the landowner sometimes also stipulated for the payment of a certain annual lease-rent in cash or cereals. As a rule, the saw-mills procured their cutting-rights at very cheap rates. The forests, at that time, had so little value that the peasants burned off vast tracts of timber land simply to obtain pasturage.



Log Transport in the Forest.

These forest-purchases formed the foundations of some of the fortunes made by the saw-mill owners; but they did not prove advantageous as regards the preservation of the forests, having, on the contrary, brought with them such serious disadvantages that they have called for the special consideration of the legislators. A speculator who by contract has acquired the right to fell timber in the forest lands of another person for a certain number of years has, of course, no interest in caring for the preservation of the forest, his sole aim being to derive the greatest possible profit from the forest during the term of the contract; and, in the cases where there was no stipulation made as to minimum dimensions, the immature timber was generally taken as well. But, even where the cutting-right was not unrestricted, many trees were felled which ought to have been left standing as seed trees or for other reasons, while other trees which, from a sylvicultural standpoint, it would have been suitable to cut down were left standing. By a law of 1889, the longest term for wood-cutting leases was restricted to 20 years. (Since the beginning of 1905 this term is limited to 5 years.) The object of this law, was, however, only imperfectly realized. Several saw-mill companies, in order to secure forests sufficient for all future wants, had previously to this already begun

to *buy up* the properties themselves, and this movement was now given a new impetus. The properties thus bought from the peasants generally consisted of a large tract of forest land and a small area of cultivated or cultivable land. Of coarse, the purchaser or company had no desire to practise agriculture, but the arable land was leased, usually to the former owner, for a very inconsiderable amount, (sometimes it was given *free* of rent) on condition that the lessee paid the taxes due on the farm.

For the care and preservation of the forests, it has undeniably been of advantage that the **saw-mill companies** obtained the possession of as extensive forests as possible; for the forests of which these companies acquired the ownership have, in general, with a view to their future preservation, been managed far better than has hitherto usually been the case with private forests in Sweden, at least with those of the peasants. But, on the other hand, the purchase of farms entailed a most serious drawback, inasmuch as the *agriculture* on the companies' farms has not been managed as it ought. The state of dependency on the saw-mill companies into which the farmers easily fell, and the danger of the number of independent farmers decreasing in consequence of the purchase of the farms by the companies, gave rise to fresh legislation, first in 1896, by the law respecting the partition of lands, which made it possible to purchase forest land without at the same time buying the cultivated land to which the said woods were attached, and, later on, when the law in question proved insufficient for its purpose, by a law issued in 1906, which forbade companies and associations, in certain cases, to purchase landed property (See the article on Agricultural Legislation, Norrland Laws).

When section-felling does not take place, all the trees to be felled are specially marked or stamped, the mark being struck both on the trunk and at the root, preferably on a large branch of the root, so that after felling it will be possible to verify not only that all marked trees have been felled, but also that no others have been. For the **felling of trees** in the forest, the owner of the saw-mill usually makes a contract with timber-drivers, who are most frequently the tenants of the company or farmers from the vicinity. If possible, the owner of the timber has some one in his own service on the spot to see that the timber is cross-cut into proper lengths; in most cases the owner himself takes steps to have timber measured. Where the working-place is too far from a village or farm for the workmen to live there, log-cabins have to be built in the forest.

Usually, timber cutting begins in October or November and continues all the winter. This season of the year offers several advantages: the logs can then most easily be brought out of the forest, the number of workmen available is greater, as farming work is at a standstill, and the sawn goods from timber felled in winter are better. It is customary to begin felling operations in that portion of the forest which lies furthest from the floating-way. In order to facilitate the transport of the timber, a large number of roads and tracks have to be made in the woods. The chief roads are made as carefully and as substantially and as wide

as possible, great care also being taken to keep them in good condition; sometimes they are iced over artificially, by pouring water over them. From these chief roads side-tracks branch off to the interior parts of the sections appointed for felling. In Northern Sweden, with its snowy winters, it is chiefly winter-roads or sledge-roads that are made.

In these times of competition, the old prodigal method of felling the tree a couple of feet above the ground, has been almost entirely abandoned, and now the tree is sawn off as near the surface of the ground as possible, and the snow, which may be sometimes one yard deep, must be shovelled away, so as to give the workmen sufficient room to run the saw. The latter tool has supplanted the axe in the felling operations, as more timber is wasted in chips by hewing. After the tree has been felled, it is "adapted" or cross-cut into one or more logs of suitable length. *Logs for sawing* are taken of a top-diameter of as little as five inches for white wood, or six inches for red wood, at a length of 15 feet. The farther from the coast, the larger the logs must be, in order to pay for their transport. *Building-timber* ought to be at least seven inches in diameter at the top, and the lengths are generally from 28 to 32 feet. *Balks* ought to be of at least 8 inches' diameter in the middle when dressed, but the length may vary. Smaller squared logs are called *rafters*. Whatever cannot be converted into larger or more valuable timber is cut up into fuel-wood, where there is a market for it.

The most usual means for transporting logs is by using a sledge. Formerly, the timber was carried on two sledges in tandem, of very simple construction, consisting of only a pair of runners, an intermediate frame, and a cross-piece joining the uppermost or front points of the runners. Nowadays, the rear sledge is usually made longer in order to avoid tearing up the road. In this manner tremendous loads, 10 to 12 logs each 18 feet long, can be drawn on the smooth winter-roads by one horse. In upper Norrland reindeer are sometimes used for hauling out timber. In such places in the forests, luckily very rare, where draught-animals cannot be used, the only means of removing the logs is by hand, and the logs are then slid, top-end first, down steep slopes, if the snow is sufficiently deep. Wheeled vehicles are used in transporting timber only on good roads, and, of course, only when the ground is bare of snow.

Floating.

Some saw-mills are fortunate enough to have forests so near at hand that some of the timber can be carted direct to the mill. A considerable quantity of timber is also transported by rail. *Floating* is, however, the most important means of conveying timber, and it is considered, besides, to have certain advantages. Coarse red wood timber which has lain in water a few months is less liable to warp, or get "shaken", than if sawn immediately after felling. The floated timber, freed from sap and resin, is, too, easier to work and has a more even colour, while that which is not floated is supposed to be more durable. Opinions differ somewhat in this respect in different places; England will take only floated timber, as it has been freed from sap and resin; other countries, like Germany and Denmark and the south of Sweden, are just as willing to take unfloated timber. — Besides the timber intended for the saw-mills, quite a con-

siderable quantity of beams or balks, charcoal-wood, pulpwood, and, in some cases, even fuel-wood, is transported by floating.

If it were not for the **floating-ways**, it would, in many cases, be impossible to make use of the forest-products from the interior of the country otherwise than for local needs. Sweden's prominent position in the world's timber trade depends, therefore, to a certain degree upon the numerous rivers and their suitability as floating-ways. In general, the rivers of Sweden run towards the south-east, south, or south-west, a matter of great importance for the floating of timber as, in consequence of this trend of the rivers, the melting of the snow and ice begins first at the mouths of the rivers and proceeds gradually up stream. This makes the ice-drift and the flood-water of less extent than in the case of rivers the course of which is to the north. As a rule, the banks of the Swedish rivers are so high that the water does not flood the surrounding country even when the rivers are highest, and so floating can proceed at this period, too. The large rivers of Norrland and Dalarne, whose sources are in the high mountain ranges, have such a constant supply of water, owing to the melting of the snow on the mountains, that floating can, as a rule, be carried on all through the summer. As regards the waterways of Southern Sweden used for floating, as well as the smaller rivers and tributaries of Northern Sweden, where the supply of water is sufficient only during the time of the spring floods, the lakes and mountain tarns through which they run have frequently been transformed into adjustable water-reservoirs in the service of the floating by means of relatively cheap dams.

There is a distinction made between *public* and *private* floating-ways. Nearly all the main waters in Northern Sweden are public floating-ways, and so are many of the tributaries. Private floating-ways now occur almost exclusively in such cases where all the forests from which timber is to be floated down the water-courses belong to a single owner. Public floating-ways are constructed, after application to the Governor of the län, by one or several of the forest owners interested therein. The line of the floating-way is then inspected by a functionary appointed by the Governor of the län. The riparian owners, and others whose interests may be affected by the proposed regulation of the waterway, having been consulted, it is then desided what constructions are to be made, what amortization is to be paid in consequence, how the floating-course shall be divided into sections, and when the construction is to take place. After the work has been completed, the final inspection takes place, and the floating-way is declared open; simultaneously, the Governor of the län issues regulations for a *Floating Company*, which has to superintend the floating and debit the expenses to the respective floaters; these costs include the amortization of the building-expenses of the floating-way.

Some of our large rivers are used for timber floating, in larger or smaller portions of their course, without any alteration, and in the very same condition that Nature created them. For the regulation of the *tributaries*, proportionately more work and expense are generally required, and, consequently, they have been adapted to floating at a later date than the main rivers were. At present most of them, probably, are cleared, but there are a few which are still untouched. Whether it will pay to form a floating-way or not, depends on the amount of

timber which can be expected to be floated down it, and on the costs of regulation. As a rule, it may be said that it pays to adapt even quite small water-courses to this purpose.

In the main waters of a large river the work of making a floating-way consists principally in blasting away rocks which form obstructions, building wooden troughs to regulate streams or waterfalls or to narrow the water-course, building facings along such river-banks as are specially liable to get washed out, and placing booms to guide the floating timber in the desired direction, thus protecting low meadows, mills and other water-works, bridge-piers, and the like. In these large rivers, and also in such smaller watercourses as flow direct into the sea, *sorting-booms* are placed at the mouths, where the floated timber is sorted according to the marks it bears, after which it is delivered to its respective owners. In the smaller rivers, besides the above arrangements, it is frequently necessary *to build dams* to regulate the depth of the water, as, since these water-courses, unlike the large rivers, are not fed by the melting snow in the high mountains, they would otherwise contain sufficient water for floating only during the spring floods. The dams are built either at the outflow of these rivers from some lake or tarn, which by damming can be used as a reservoir (which is the most usual manner), or at the lower end of some swamp, which is then made to serve the same purpose, or else in some part of the water-course that runs more slowly (dead water). The dams, as a rule, consist of stone coffers, strengthened in the front by banks of earth. In the dam there are made openings, which, by means of hatches, can be entirely or partially closed, whereby the height of water can be regulated. A special opening (the outlet-sluicer or "shoot") is made in the dam for the escape of the logs. Like the other openings it is provided with timbered walls and a somewhat sloping floor of round timber.

Floating-channels (flumes) can, as a rule, not be dispensed with in the smaller floating-ways. A precipitous stream with small water-supply, a large fall, an irregular river-bed with large stones at the bottom, — such conditions make floating channels indispensable. The trough or flume is made of timber and is either supported by trestles or by beds of timber or stone, the latter being employed when the flume lies low. In certain places (in Dalarne) the wooden channels have been superseded by flumes of sheet iron, which have proved very practical. — To ensure good floating, a tolerably equal depth of water should be maintained all through the channel, and, consequently, the channel must be made narrower where its slope is greater. The width should be relatively large at the beginning of the channel and then decrease somewhat, because part of the water is always lost by evaporation and leakage. The width and depth of the channel, too, are adapted to the supply of water and the quantity of timber to be floated. An incredibly large quantity of timber can be conveyed in a well-built floating-channel, even if the dimensions of the flume are not considerable.

In front of the inlet of the channel there are *leader-booms*, so that the timber is carried forward by the current toward the opening, where there are always workmen posted, however, to regulate the entrance of the logs, which should enter the channel evenly and so slowly that they do not accumulate in such numbers as to burst the channel. By means of a *system of signals* it is possible to give notice, if necessary, from any part of the channel when the feeding-in of the logs is to be interrupted. The lower end of the channel has a slight slope, so that the logs will not strike against the bottom when they leave the flume. If the water-course is shallow here, there is built below the trough of the channel a "sliding bottom", of round timber, over which the logs slide; this flooring, consequently, receives the first shock of the issuing logs.

Other constructions also occur in the floating-ways, such as fascine-coffers, canals dug in the ground, etc. The most important means for clearing or regulating the floating-ways is, however, by the blasting of rocks, and their subsequent removal from the bed.

The work of **floating** commences simultaneously with the breaking up of the ice in spring. On the smaller floating-ways, especially, it is important to make good use of time; in certain cases, one day's delay may be the cause of part of the logs remaining unfloated till the next year. The same result may ensue if the number of workmen (or drivers) is insufficient. The timber may be floated separately or united in rafts; the latter method of floating being especially used when the stream is not very rapid. If the timber is laid up on the ice in some lake or marsh, it is enclosed by booms of heavy logs, chained together, so as to form a ring-boom or "halter", frequently enclosing several thousand logs. This ring-boom is either *towed* by a steam-tug or else warped along by means of a capstan placed on a raft especially built for the purpose.

When the timber has entered the floating-way, it is necessary to keep it clear of the land by means of boat-hooks (driving poles), to increase its speed in certain cases, and to prevent, as much as possible, the forming of "jambs", or blocking. Wherever such jambing occurs, the logs must be loosened, which may be not only a difficult task, but a dangerous one, too. If it is possible to find the log which has caused the jamb, it is sufficient to chop it off, after which the heaped timber comes adrift again of itself and disperses; otherwise the logs have to be hauled out of the jamb one by one. However, it is now rare that fatal accidents occur at this work. — On all floating-ways a large number of hands are stationed at the upper part of the way to break loose the logs which, in floating, have got lodged or fastened along the bank (bank-jambs). When this work has been carried down as far as to the sorting-booms, the general floating is finished for the year. In most water-courses there is now time for the logs to reach the saw-mills during the course of the *first summer* after they are felled, while, formerly, before the floating-ways were regulated, it was usual for the logs to be two or even three summers on their way through the water-courses. The *loss* of timber in floating does not even amount to one per cent, in some Norrland rivers.

Usually the floating-way is divided into sections, and the cost is calculated separately for each section. The floating in the upper sections is relatively more expensive than in the lower ones.

A fairly good idea can be gained of the importance of the timber floating-network of Sweden, when we learn that the total length of these floating-ways is estimated at about 29 000 kilometers. Some 23 000 kilometers of this belong to the general floating-ways, and about 6 000 kilometers to the private ones. The floating-ways are of greatest importance in Northern Sweden, where, in Norrland alone, they amount to more than 23 000 kilometers, while in Dalarne they come to about 3 000 kilometers.

The expense of establisl ng these floating-ways can be estimated as having been about 60 million kronor. This sum does not include working-

expenses and up-keep, the cost of which is an annual charge on the timber floated. In consequence of its cheapness, floating becomes a very important factor in the timber trade. It is true that the cost of floating varies very greatly in different floating-ways, and also in consequence of various circumstances, such as the supply of water, the amount of timber floated, etc. For the larger floating-ways, however, the expenses are estimated as varying between 3 and 14 öre per new Swedish mile (six English miles), per cubic meter timber, fast measure. In the case of smaller floating-ways the corresponding expenses can be many times larger. The expenses quoted for the large floating-ways are considerably lower than the freight-charges for the transport of round timber by rail. The freight charges per whole railway-truck, per cubic meter of timber, per new Swedish mile (10 km), amount to:

17 öre for a distance amounting to 15 new Swedish miles
21 » » » » » 10 » » »
28 » » » » 5 » » »
59 » » » » » 1 »

The exceptional condition prevails with regard to the floating-ways that the average expense of the floating of timber per length-unit of floating-way, when the timber is transported through two or more separate districts, becomes proportionally larger the greater the distance the timber is floated; as a rule, it costs more in the upper reaches of the floating-ways than in the lower districts.

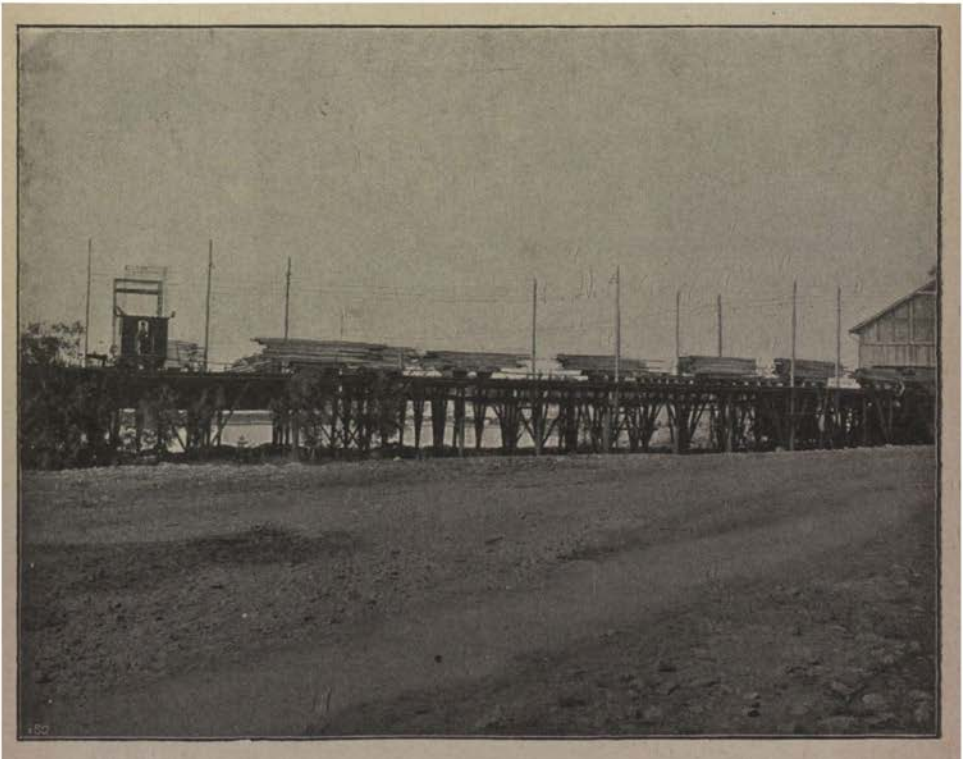
There exist no uniform reports respecting the *amount of the timber which is floated down.* As a rule, the timber thus floated is reckoned by the piece, varying in proportion to the cubic mass, whether it be sawn timber or other timber reduced to floating-units (Sw. klampar) which vary according to the floating-ways. In the case of most of the floating-ways, these floating-units do not correspond to a fixed cubic mass, but, during the last few years, the expenses of floating have begun to be calculated per cubic-unit of the timber. By this means it will gradually become possible to obtain, among other things, fairly satisfactory statistics respecting the amount of timber handled. — During the first few years of the present century, some 40 million pieces of timber were floated every year in Norrland, Dalarne, and Värmland together. The corresponding figure for 1912 is estimated at about 90 millions. During the last few decades, the dimensions of the timber floated have been on the decrease, this being the result, in the first place, of the increased floating of pulpwood and pit-props.

For particulars concerning water-courses etc., see the article on Hydrograhpy, p. I, 20.

Sawing and Export.

When the floated timber has reached the saw-mill, it must first pass the *sorting-booms*, where it is sorted according to size (into deal-logs, batten-logs, etc.). By means of a windlass or capstan, the logs are now hauled up a sloping

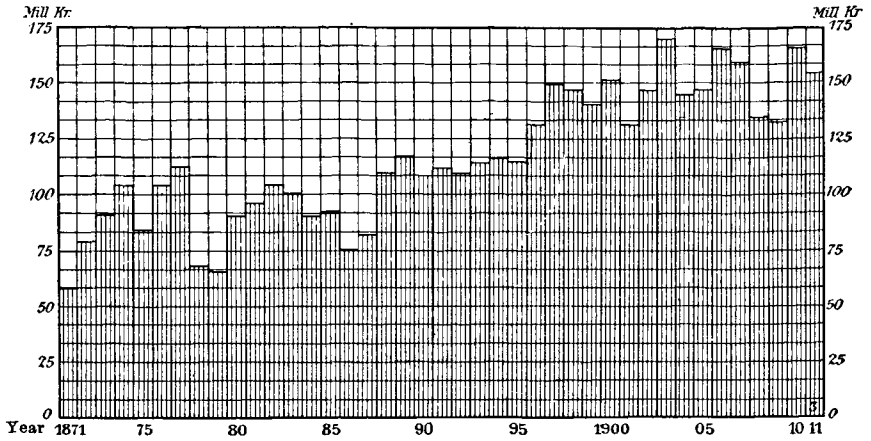
bridge into the mill. One end of the log is then attached to a frame on wheels ("log-carriage"), while the other end rests on a cylinder or roller near the *saw-blades*. The latter are stretched in a strong swing-frame, which runs up and down in the bearings of a pair of upright frames. The movement of the swing-frame is produced by a rod secured to the lower edge of the frame, whose other end is connected with a crank, which is caused to rotate by wheels. By means of gearing connected with these, the log-carriage is led forward, while the sawing is going on. The number of saw-blades in a frame depends upon the size of the logs and the thickness of the boards to be sawn, so that the log is sawn up into boards at its first passage through the frame, unless square-sawing is adopted, which is frequently the case with large logs; in this case, the logs are first sawn on two outer sides before the sawing proper begins in the next frame. On account of the evenness of Swedish timber, it has not been found necessary to make use of band-saws, the working up of the logs being made almost everywhere by gang-saws, which, in its simplest form, is of the kind described above; at large saw-mills with modern appliances, special machines are often used to perform the work more rapidly.



Transporting Timber to the Lumber-yard.

The saw-blades are changed every time a new dimension is to be sawn. In this respect the large saw-mills have an advantage, as they can with more facility saw several dimensions at a time without needing to change frames so frequently. The old saw-blades were rather thick and had a long stroke, so that they consequently worked slowly and wasted much timber (about 10 %). On account of the increased prices of timber, and under the influence of competition,

Value of the Export of unwrought, hewn, and sawn Timber, 1871—1911.



however, great efforts have been made to remedy these deficiencies as much as possible. The saw-blades are now made quite thin, and consequently they require a smaller "set" (the alternate inclination of the saw-teeth sideways), and give less saw-dust, but a smoother surface. — After the logs have passed through the frames and have been cut into boards, they are finished by *edging*, the boards being then passed between the two circular saws of the edging-machine.

The boards or deals are now arranged according to their different dimensions, and, where necessary, are sorted according to quality, after which they are run into the lumber-yard on trolley-cars and piled up in stacks to dry. The dimensions of sawn wood can vary between 12 in. (Engl.) by 4 in. down to 1 in. by 1/2 in. The most usual kinds are *deals*, *battens*, and *boards*, which are also the largest dimensions; there are also scantlings, planchettes, fence pales, glass-box boards, slatings, and *staves*, which are made in special stave machines, from the waste resulting from frame-sawing (laths and slabs).

Timber of good **quality** is characterized by the wood being sound and as far as possible free from knots, and by its being close-grained. This quality depends upon the shape which the trunk of the tree had (a "pillar-shaped" tree gives the best timber), and upon its being cut before its growing capacity has essentially ceased. Many things may deteriorate the quality of the wood, e. g. "discolouration", which arises from fermentation of the sap; cracks or warping ("shakes"), which are caused by uneven seasoning, or else depend upon the tree being too old, and "wane", caused in sawing. — *Sorting* is a very important work, and the men who perform it, the *brackers* (klampare) receive higher wages than others.

Sawn timber, especially red wood, is sorted according to quality into firsts, seconds, thirds, fourths, and fifths. White wood is often shipped unsorted. — In addition to the French sorting, as it is called, there was formerly employed another classification for shipments to English-speaking countries, where a distinction was made between "mixed" (this properly signifying seconds with a mixture of firsts), 3rds, 4ths, 5ths, 6ths, and "wrack" or "wreck" (wrack-refuse). Consequently, 3rds in the

TABLE 36. *Sweden's Exports of unwrought, hewn, and sawn Timber, according to kind.* Cubic meters.

Kinds of goods	Annually 1886—90	Annually 1891—95	Annually 1896—00	Annually 1901—05	Annually 1906—10	Year 1911	Year 1912
Timber and masts.[1] .	155 543	118 445	75 380	71 779	45 254	14 316	24 772
Spars and small timber	32 586	52 553	69 306	133 484	180 690	179 091	158 454
Beams or balks[2] . .	103 279	75 774	67 953	60 032	45 747	48 049	41 540
Rafters	178 099	224 464	258 146	310 514	346 951	310 100	328 654
Pitprops	513 749	744 891	871 391	965 634	622 892	524 217	440 192
Sleepers	11 490	10 820	48 056	42 916	61 547	43 760	81 094
Staves	44 400	46 822	47 246	65 606	88 395	111 913	128 751
Fuel-wood	93 484	95 144	72 559	70 619	49 053	30 287	31 006
Deals, battens and boards[3], unplaned . .	3 561 999	3 894 857	4 371 394	3 940 514	3 605 628	3 530 437	4 024 326
Planed boards[3] . . .	193 210	273 993	467 290	580 193	571 287	687 599	656 212
Deal- and boardends.	283 362	352 558	372 010	384 884	328 795	314 935	303 241
Other kinds	33 070	63 145	101 407	126 579	105 752	255 208	78 526
Total	**5 204 271**	**5 953 466**	**6 822 138**	**6 752 754**	**6 051 991**	**6 049 912**	**6 296 768**

[1] Measuring 25 centimeters or more in diameter at the small end. — [2] Measuring 20 centimeters or more at the middle. — [3] Including box-boards.

English classification corresponded to secunds in the French. — Timber from Dalarne and Southern Norrland ("Nederbotten") generally yields more first-class wood than that from Överbotten, "the Upper Gulf", or the districts north of Umeå.

The time during which the timber must lie and *season* is of varying length, depending partly upon the time of the year, partly on the kind of wood (white wood seasoning quicker than red wood), and partly upon the country for which the sawn wood is intended; the wood to be shipped to the tropics needs to season longer than other wood, as does the wood intended for planing.

Before the wood is ready for shipping, it must also be given the desired *length.* It is true that, immediately after the felling of the trees, the logs have been cut into certain given lengths, but during the process of floating or in transportation, they have got damaged or worn at the ends: and therefore the logs are cut about 12 inches longer (wearing allowance) than the length stipulated for delivery. Besides, in case any blemishes, e. g. dry rot or wane, happen to occur near the end of a board, it is more advantageous to cut it off, so as to get a somewhat shorter board of perfect quality and also a board (or board end) of inferior quality. For this reason the sawn goods are marked with a line showing where they are to be cut off. After having thus been *adjusted,* they are cut off by means of a *cross-cutting saw.* This cross-cutting may be done by hand and is not infrequently done in that way, but at the large saw-mills electric cross-cutting machines are used and electric feed-rollers, on which the boards are run automatically from the stacks to the crosscutting saws.

Several saw-mills are combined with **planing-mills.** In Sweden there are comparatively few planing-mills worked independently.

For the better utilization of the waste, many saw-mills have established charcoal works and wood-pulp works. For the latter see under Wood-Pulp Manufacture.

As will be seen by Tables 36 and 37, the principal **articles of export** among wood-wares are sawn products: *deals, battens,* and *boards.* Great Britain is the most important purchaser of these goods, and next comes, in ordinary years, France; among other importing countries may be mentioned Germany, the Netherlands, Belgium, Denmark, and South Africa. For planed boards, besides Great Britain, Denmark, the Netherlands, South Africa, and Australia are the most important markets. In several of the countries of the European continent the import of planed boards is hampered by high duties. — *Firewood* or *splitwood* (more properly termed deal- and board-ends, not more than 2 meters in length) consists of such serviceable pieces as are left after the sorting. The quantity, of course, de-

TABLE 37. *Exports in 1912 of unwrought, hewn, and sawn Timber, according to Customs districts.* Cubic meters.

	Deals, battens and boards (includ. box-boards), unplaned	Planed boards (includ. box-boards)	Beams and rafters	Round timber	Pit-props	Other kinds	Total cubic-meters
Norrland:							
Haparanda, Luleå, Piteå	350 932	56	45 946	12	1 659	38 614	**437 219**
Skellefteå, Umeå	376 851	69 918	60 583	619	22 759	82 464	**613 194**
Örnsköldsvik	128 123	19 311	2 755	841	13 075	23 645	**187 750**
Härnösand	608 328	20 168	29 549	16 877	51 544	113 905	**840 371**
Sundsvall	618 187	164 645	31 474	1 178	19 959	85 218	**920 661**
Hudiksvall, Söderhamn	475 430	80 873	42 841	271	54 983	56 986	**711 384**
Gävle	431 267	50 266	—	7	11 163	39 010	**531 713**
East Coast:							
Stockholm	90 961	657	823	—	2 761	5 240	**100 442**
Norrköping	108 109	13 095	9	5	1 215	3 691	**126 124**
Västervik	51 220	3 351	146	—	18 572	2 093	**75 382**
Oskarshamn	59 932	678	5 900	100	27 078	6 114	**99 802**
Kalmar	45 935	853	13 325	2	34 370	4 824	**99 309**
Other districts[1]	81 378	734	2 265	—	20 826	25 541	**130 744**
West Coast:							
Gothenburg	291 253	118 738	695	15 032	85 285	80 664	**591 667**
Other districts[1]	306 420	112 869	133 883	148 282	74 943	54 609	**831 006**
Summary:							
Norrland	2 989 118	405 237	213 148	19 805	175 142	439 842	**4 242 292**
East Coast	437 535	19 368	22 468	107	104 822	47 503	**631 803**
West Coast[1]	597 673	231 607	134 578	163 314	160 228	135 273	**1 422 673**
Total	**4 024 326**	**656 212**	**370 194**	**183 226**	**440 192**	**622 618**	**6 296 768**

[1] Including the quantity exported by land to Norway.

pends upon the extent of the saw-mill business. The export goes principally to Great Britain, and a smaller portion to Denmark and other countries. Formerly deal-ends were chiefly used as fuel, but of late these goods are being used for making packing-cases and the like.

The export of *round timber* of larger dimensions has long been stationary, or even decreased somewhat. To this sort of timber belong Dutch timber or Dutch balks; the latter designation is incorrect — it has probably risen owing to the fact that, on shipping, two sides of this timber is slightly hewn at the butt end, partly for the purpose of calculating the dimensions, and partly to make the balks lie more securely in place when loaded. Dutch balks of ordinary size measure 24 feet in length and 10 inches in diameter at the top; they are usually of white wood, seldom of red wood. The export goes to Holland, were the timber is afterwards generally sawn; sometimes it is used as piles and for building dams) nowadays, however, poorer timber, such as dead wood and the like, is used for piles). The export of Dutch balks has decreased for two reasons: in the first place, the demand for them in the Netherlands has diminished since a large quantity of planed boards have begun to be imported into that country, and further, the supply of the raw material has decreased, as the forests have come into the hands of the great saw-mills whose owners, for natural reasons, prefer another use for the timber.

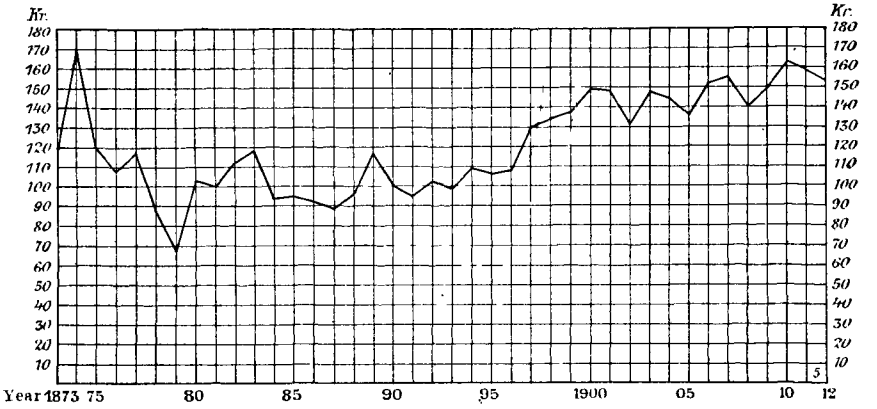
For heavy *beams* (balks), old, over-ripe trees are preferably taken, and, as the supply of these is decreasing, the amount exported has diminished considerably: the competition in price with American pitch-pine has also

TABLE 38. *Export of unwrought, hewn, and sawn Wood-wares to different countries 1912.* Cubic meters.

Countries	Deals, battens and boards (incl. box-boards), unplaned	Planed boards	Beams and rafters	Round timber	Pit-props	Other kinds	Total cubic meters
Norway	104 245	35 635	3 417	123 297	10 366	20 324	**297 284**
Denmark (with Iceland)	370 934	80 512	130 994	24 033	193	79 283	**685 949**
Great Britain	963 047	313 434	17 379	14 194	425 217	428 971	**2 162 242**
Ireland	22 431	36 997	—	760	—	262	**60 450**
The Netherlands	211 024	32 135	8 779	19 066	—	31 900	**302 904**
Belgium	174 525	327	—	—	—	14 029	**188 881**
German Empire	726 324	5 154	101 477	960	3 468	30 770	**868 153**
France	861 549	229	19 788	585	—	12 726	**894 877**
Other European countries[1]	246 327	6 431	13 902	—	65	643	**267 368**
British South Africa	90 731	47 221	—	—	—	3 361	**141 313**
Egypt	65 476	12 563	66 757	243	—	—	**145 039**
Other countries in Africa[1]	104 888	13 339	68	88	883	333	**119 599**
Asia	13 013	13 484	7 633	—	—	10	**34 140**
America	48 243	5 887	—	—	—	—	**54 130**
Australia	21 569	52 864	—	—	—	6	**74 439**
Total	**4 024 326**	**656 212**	**370 194**	**183 226**	**440 192**	**622 618**	**6 296 768**

[1] The Canary Islands are included with Spain.

Prices at Sundsvall and Nederbotten[1] *of thirds red battens* 2^1 2″ × 7″, *1873—1912.* Kronor per standard.



[1] For the years up to and including 1901, the prices are those of battens from Sundsvall, after which they are those from Nederbotten. Probably no great differences are caused by this fact.

contributed to this. On the other hand, the export of *rafters* and small balks has increased somewhat. Among countries affording a market for rafters we should mention, besides Denmark and Germany, Egypt, where rafters of small dimensions are used for roofing the Arabian huts. About twenty years ago, these Alexandria rafters, as they are called, were taken from the Austrian ports on the Adriatic, but now they are shipped from Sundsvall. — Rafters are exported from most of the Norrland ports, as well as from Kalmar, Malmö and Halmstad.

Railway-sleepers are now turned out in large quantities at the sawmills of the southern provinces. The export goes principally via Gothenburg to England.

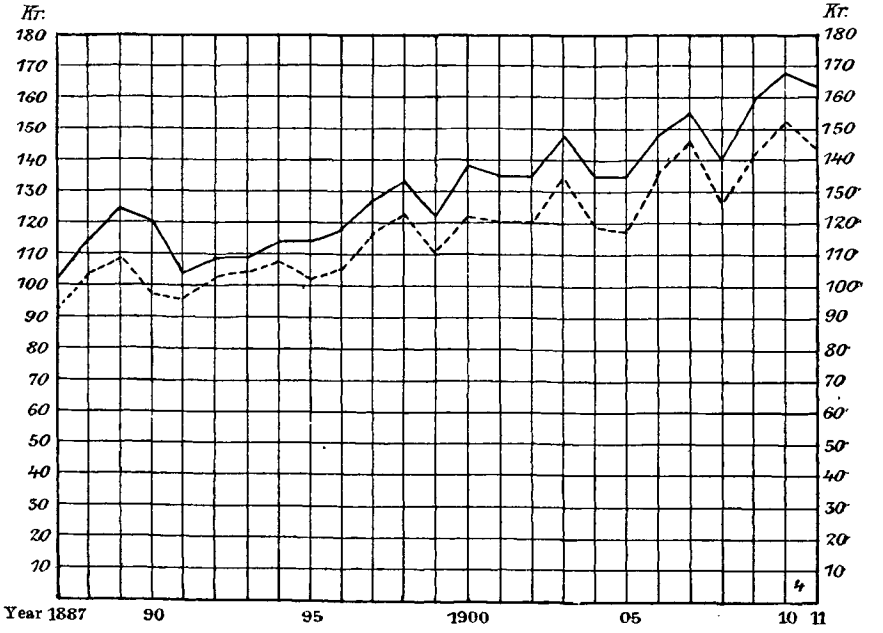
One branch of the timber industry which has long been regarded with a certain ill-will or suspicion is the export of *pit-props*. The ill-will is naturally caused by the fear of forest exhaustion, and this fear is by no means groundless. The cutting of pit-props would have no injurious effects, if for this purpose were used only such undersized trees, as, from a rational sylvicultural point of view, are to be condemned; but it is most destructive when, as is often the case, all the young timber is mown down. The main part of the pit-prop export is from South Sweden, from which most of this timber originally comes; but from Norrland also a good deal is exported. This article goes almost exclusively to England.

Pulp-wood is principally shipped from Gävle and Söderhamn and goes to Great Britain, France, and Denmark.

The export of *staves* and *headings* (both of hard wood and of red and white wood) shows considerable fluctuations from year to year, but, on the whole, it has increased.

Average Prices (in kronor per standard) of exported Sawn and Planed Wood.[1]

Sawn (rough). ——— Planed.



[1] Based on reports kindly given by G. Askergren, Chief Clerk to the Swedish Timber Export Association.

Among *other kinds* of unwrought timber, we may here briefly mention only laths and trellis-wood, which is almost exclusively shipped to England and Denmark, and wood for fuel, which is principally exported from our most southerly ports to Denmark.

As regards **value,** deals, battens, and boards (unplaned), and other sawn goods were, in 1912, by far the largest item in the Swedish timber exports, amounting to no less than 119·3 million kronor. Planed boards were exported to a value of 22·5 million kronor. Then come beams (balks) and rafters, to a value of 7·7 million kronor, round timber to a sum of 3·9 million kronor and pit-props to 2·6 million kronor.

The not unimportant export of wood wares to Norway is carried on only in part by sea (about 30 000 cub. meters), part is sent by rail, and part is floated. Of course it is mostly timber and other round goods that are floated.

In regard to the **prices of timber,** particulars are certainly given in our commercial statistics, but it is difficult to summarize these figures for the different kinds, so as to give a distinct idea of the fluctuations of price. Instead, we here give a diagram for one of the most important kinds, namely "thirds" in red battens (according to the present french sorting; see above), which will no doubt give a pretty faithful idea of the average

rise or fall. It may be pointed out, however, that in the case of several kinds of timber, especially planchettes and other sawn goods of smaller dimensions, the rise of late has been greater than for red wood battens.

The diagram illustrates the changes in price from another point of view, as it shows the variations *in the average price of the exports, actually existing*. In its movements up and down, this average price can present differences from those distinguishing a special kind of wood goods, even if, as is the case with the 3rds red wood battens, they may be considered as belonging to the leading specifications. If, for example, there is a diminution in the available quantity of sorts of timber of larger dimensions and of the best quality, the average price of the actual exports can remain constant or even fall, although, at the same time, the market prices of the different kinds of timber rise.

The **import** of unwrought timber (when the timber floated from Norway is not taken in acount) is insignificant in comparison to the export (compare Table 34) but, on the whole, it is increasing. Its value, in 1912, amounted to 19 051 000 kronor, and the quantity was about 515 000 cub. meters.

The principal sorts of imported timber of *native kinds of wood* are timber and spars of different dimensions, and fuel-wood, especially birch, which comes almost exclusively from Finland. Aspen wood (for the manufacture of matches) comes principally from Russia. Unwrought *foreign kinds of wood* are also imported (in 1912 the value amounted to 525 000 kronor), of which the greater part comes via England and Germany.

By-trades connected with Forestry.

Sweden's vast forests and highly developed timber trade give ample opportunity to a number of by-trades, but as it is generally the tendency of the Swedes to overlook *small* gains, such is the case here too. It is true that, of late, these products of the forests have been gleaned far more thoroughly than before, but a lot of waste-timber is still left to rot in the forests of the country, and many a by-trade connected with forestry has not yet been started or only leads a languishing life.

Concerning **Wood-Pulp** manufacture see the Section Timberware Industry below.

The most important of the, so to say, lesser industries of forestry is without doubt the manufacture of **charcoal,** a subject which is thoroughly dealt with in the following, under the heading of Mining. Nothing more need be pointed out here than that, of late years, a great number of sawmills have carried on the manufacture of charcoal on a large scale, with the waste timber from the mills as raw material. The burning-process is carried out either in special charring kilns, or by burning in stacks. (Sw. milor.) The letter method is, too, one that has been used in forest-districts since ancient times.

Altogether, there were in Sweden in 1912 a total of 407 charcoal works on a large scale. They employ more than 6 600 hands; and the value of the output is estimated at 12·7 million kronor. (Cf. also Iron and Steel Industry).

Tar-hollow.

In olden times, the preparation of **tar** was a considerable industry in Sweden, and wood-tar was one of the most important export articles of the country. The export mostly went via Stockholm, and Stockholm tar was considered the best. Nowadays this manufacture is principally confined to the two northernmost läns; the chief place of export being Umeå. Some

TABLE 39. *Imports and Exports of Tar and Pitch.*

Annually	Tar Quintals		Coal-tar Quintals		Pitch Quintals		Total value Kronor	
	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.
1871—75	17 159	83 148	5 942	48	1 551	1 418	173 000	1 069 000
1876—80	14 873	70 437	16 181	392	2 248	1 610	278 000	896 000
1881—85	9 400	83 412	24 880	1 826	3 950	727	287 000	1 245 000
1886—90	11 995	54 270	20 296	12 042	2 995	803	236 000	673 000
1891—95	17 169	57 991	16 217	21 317	2 274	982	276 000	756 000
1896—00	17 640	40 185	28 580	26 103	8 077	598	385 000	541 000
1901—05	12 757	43 222	26 744	16 514	29 324	455	664 000	633 000
1906—10	9 367	74 212	34 911	32 122	28 917	1 051	546 000	1 055 000
1911	12 882	73 811	37 661	19 191	30 000	2 093	598 000	1 290 000
1912	10 932	62 689	60 969	22 451	31 151	2 186	615 000	610 000

figures are given in Table 39, concerning the imports and exports of tar and pitch during later years. The manufacture of tar is made either in open, so-called "tar-hollows" (see illustration below) or in so-called "tarring-furnaces". There are also some small establishments for production on a larger scale.

The manufacture of **potash** has decreased considerably; it even appears to be on the point of extinction.

As a by-trade of forestry is sometimes reckoned **peat-digging** and the industries connected with it, which, however, is scarcely correct. Now-a-days, peat-production has developed to on independent trade of great importance, possessing still greater future possibilities. An account of the present state of things in this connection is given in the following pages under the heading: Manufacturing Industries.

V.

SHOOTING AND FISHING.

1. SHOOTING AND SHOOTING LEGISLATION.

In ancient times, shooting and fishing were the chief sources of subsistence of the inhabitants of the North, but after cattle had begun to be raised and the soil had begun to be tilled, shooting was no longer a necessity for the support of life, but was diligently practised, partly as a valuable subsidiary source of subsistence, and partly to protect the herds from beasts of prey; it was, besides held in high esteem as a manly sport.

Game, which was at that time very plentiful, was considered as "belonging to nobody", and it could be freely hunted everywhere. With the gradual progress of civilization and the consequent decrease of game, legislation began to impose restrictions on the general right to free shooting, and the owners of land were given the sole right to shoot over their own land, with an exception in the case of beasts of prey, which could still be hunted and killed anywhere by anybody. But in course of time the idea became prevalent that the right to shoot, even on private ground, belonged to certain privileged persons, and by the Royal Statute of Aug. 29, 1664, the landed peasants almost entirely lost the right to kill or catch game not looked upon as beasts of prey. Only by the Royal Ordinance of Febr. 21, 1789, more minutely confirmed by the Royal Statute of April 13, 1808, was the right of landowners to shoot over their own property re-established.

The game-law now in force, issued Nov. 8, 1912, also recognizes as its main principle the right of the landowner to shoot over his own land, but if the land is let to anyone for tillage, the right of shooting over it goes to the tenant, unless otherwise agreed. Consequently, unless a special agreement is made, no one may shoot over land owned or leased by another person. Exceptions are made, however, in the case of the *wolf*, the *glutton*, and the *seal*, or seadog, which may be killed wherever they may be found, even if they happen to be on another person's property.

A subject of a foreign power may not employ firearms for hunting purposes in Sweden unless he be provided with a *shooting-permit* issued for him personally: such foreign subject, however, is entitled, without a permit, to shoot game, etc., on an estate which he has the royal consent to own in Sweden. Shooting-permits are issued by the governments of the läns on written application and are available anywhere in the kingdom. Permits available for the whole year cost 100 kronor; day-permits cost 5 kronor. They do not permit the holder to shoot elsewhere than on estates of which he has obtained the shooting-rights.

Bear.
From a painting by BRUNO LILJEFORS.

The shooting-rights of private individuals are restricted by regulations issued by the Government in special *Game Statutes*. According to these regulations, game which has any value may be killed only during fixed *shooting-seasons*, which, for the most part, are so arranged as to afford the game protection during pairing-time and until the young are big enough to look after themselves. In consequence of the difference in the conditions prevailing in the northern, central, and southern part of the country, the shooting-season for the same kind of game often varies for these various zones. Apart from some few local differences, the following *shooting-seasons* are those allowed at present for the more important kinds of game:

Elk: In the Läns of Norrbotten, Västerbotten, Västernorrland, and Jämtland, and in the northern parts of Kopparberg Län, $^{9}/_{9}$—$^{15}/_{9}$; in Gävleborg Län and in the remaining districts of Kopparberg Län $^{10}/_{10}$—$^{16}/_{10}$, and in the other parts of the kingdom $^{10}/_{10}$—$^{23}/_{10}$.

Roe-deer: everywhere in Sweden $^{16}/_{9}$—$^{31}/_{12}$.

Hare: in the Läns of Norrbotten, Västerbotten, Västernorrland and Jämtland ^{1} 9—$^{28}/_{2}$; in Malmöhus and Kristianstad Läns ^{16} 9—$^{31}/_{12}$; and in the remaining parts of the country $^{1}/_{9}$—$^{15}/_{2}$.

Capercailzie.
From a painting by BRUNO LILJEFORS.

Hazel-grouse, ptarmigan, capercailzie, and *black-game:* in the above-mentioned northern Läns $^{21}/_{8}$—$^{28}/_{2}$, and, in the other parts of the kingdom, hazel-grouse, ptarmigan, capercailzie- or mountain-cock, and black- or heath-cock $^{21}/_{8}$—$^{31}/_{12}$, capercailzie- or wood-grouse hen and heath-hen $^{21}/_{8}$—^{15} 10.

Partridge: in the northerly Läns above-mentioned ^{16} 9—$^{15}/_{10}$; in the Läns of Malmöhus, Kristianstad, Halland, Göteborg och Bohus, Blekinge, and Gottland $^{16}/_{9}$—$^{15}/_{11}$, and in the other parts of the country ^{16} 9—$^{31}/_{10}$.

Woodcock: everywhere in the kingdom $^{16}/_{5}$—$^{31}/_{12}$.

Wild duck or mallard (Anas Boschas), *snipe,* and a number of other small-sized *waders:* in the above-mentioned northern Läns ^{11} 8—$^{31}/_{12}$; in the Läns of

Malmöhus, Kristianstad, Halland and Blekinge $^{16}/_{7}$—$^{31}/_{12}$, and in the other parts of the country $^{1}/_{8}$—$^{31}/_{12}$.

Eider: on the west coast $^{1}/_{11}$—$^{15}/_{2}$; on the east, female and year-old birds $^{1}/_{9}$—$^{20}/_{4}$; male birds all the year, excepting between $^{21}/_{4}$—$^{21}/_{5}$.

Poachard (Fuligula): in general $^{11}/_{8}$—$^{31}/_{12}$ and $^{1}/_{4}$—$^{20}/_{4}$, although in some places the period is longer for one or two varieties.

A great number of species of *birds useful to the farmers* are protected during the period $^{1}/_{3}$—$^{15}/_{9}$.

In spite of the above restrictions in the shooting-seasons and of other regulations for the protection and preservation of game, the supply of game useful for food is not so large as could be desired, excepting on a number of large estates in the south of the country, where there are extensive game-preserves. The causes of this are to be sought partly in climatic influences, which frequently act injuriously on the development of the year's broods, partly in excessive shooting over properties which, in consequence of the continual breaking up of large estates, etc., are growing smaller and smaller, and, finally, in the excessive number of wild beasts, etc., which pursue the useful game and destroy the young and eggs. The number of the larger animals, such as *elk* and *roe-deer,* seems to be increasing, however, rather than decreasing — in some parts of the country, at least — as a result of the protection afforded to them by the law. This is shown in the case of the elk by the official figures giving the number of these animals killed. For example, there were shot

In	1895	a total of	1 409 elk
	1900	»	2 414 »
»	1905		2 864
	1910	»	2 961 »

One thing that greatly contributes to this increase is, probably, the fact that the larger beasts of prey, the *bear, wolf, lynx,* and *glutton,* in consequence of the keenness with which they have been hunted, have now been driven back to the forest and mountain wilderness in the north-west of the country. The following figures show the extent to which these animals have diminished during the last half century:

Killed during the quinqennial period:	Bears	Wolves	Lynx	Glutton
1861—1865	532	556	679	546
1901—1905	62	146	49	465
1912	9	24	16	65

In order to prevent the extinction of the bear, this animal now enjoys protection in the Crown parks in the northern part of the country, while the bounty for killing lynx is no longer given. Bounties are nowadays paid by the State for wolves (50 kronor) and gluttons (10 kronor). Bounties of varying amounts are paid in most parts of the country by the County Councils, by Agricultural Societies, by communes, or by associations for the preservation of game, for the killing of wild animals of lesser size, such as foxes, badgers, hawks, great owls, crows, etc. The following

numbers of small animals and birds of prey are stated to have been killed in 1912: Foxes 16 706; martens 121; otters 34; badgers 5 049; seal-dogs 7 274; eagles 201; great owls 438; hawks 14 027; crows 253 913.

If we make a survey of the stock of useful game in the country, we find that the *elk* occurs more or less frequently in most of the provinces from the north of Skåne up to Norrbotten and seems to show a tendency to spread even to the territories where it is not at present generally found. Among the other cervidæ, the *wild reindeer,* formerly numerous in the mountain districts, has almost entirely disappeared from the fauna of the country. The *red-deer* occurs only within a very restricted area in the south of Skåne. The *fallow-deer* is kept principally within fenced deer-parks, although exceptionally it occurs in i wild state in some parts of the last-mentioned provinces; the *roe-deer* is rather numerous in the southern parts of the country and shows a tendency to spread northward. Among other mammals, the *hare* is the animal most generally shot. Over a great part of the country it is hunted with harriers, and this manner of hunting ought, possibly, to be regarded as the most national and the most typical for the country. In the southernmost läns, *the European hare* has been introduced during the last few decades and, in some places, has propagated itself very considerably, even to the point of supplanting the indigenous animal.

Among the rasores, the *capercailzie,* the *black-game,* the *hazel-grouse,* the *ptarmigan,* and the *partridge* are the favourite quarry of sportsman. They occur, more or less numerously, according to the nature of the ground, the capercailzie and the hazel-grouse chiefly in the back-woods, the black-game in forest- as well as pasture-land, and on heaths, the ptarmigan only in the mountain districts, and the partridge in cultivated land. The pheasant has been introduced in many places and, where the locality is favourable, seems to thrive. Among wading birds, the *woodcock* is much esteemed as game. It breeds in most parts where damp woodland is to be found but is decreasing in number, in spite of the fact that Sweden is one of the few countries where this beautiful bird is protected by law during part of the breeding time. This is also the case with the *common snipe,* which, in consequence of the continual drainage of the bog-lands is being deprived of suitable breeding-grounds. Among swimmers, the *mallard,* as far as shooting is concerned, is doubtless the most important, and it occurs in varying numbers both in the interior and along the coast. On rocks and cliffs in the sea, as also in mountain lakes and rivers in Norrland, several species of *poachards* breed, which, like the mallard, are migratory birds and, during their flights in autumn and spring along our coasts, are eagerly hunted by the coast-population, who also exact heavy tribute from other swimmers dwelling along the coasts.

From an *economic* point of view, shooting is not nowadays of the same importance as before, when the supply of game was more ample. Probably only few of the inhabitants of the country are now to be able to make a living out of hunting. In the Lappland districts of the läns of Norrbotten and Väster-

botten, and in some parts of the län of Jämtland, where the trapping of forest birds and ptarmigan is still permitted by the law, the poor population are, perhaps, able to obtain a considerable contribution to their means of livelihood. Considerable quantities of birds obtained in this way are annually sent in a frozen state from these regions to more southern parts of the country. The hunter who succeeds in killing an elk or two in the year can also be said to make a good profit, as a full grown elk has a value of 75 to 150 kronor. That the coast-population can gain some sort of livelihood out of sea-fowl is mentioned above. Otherwise, only a comparatively small profit can be gained by the individual out of shooting, as long as the stock of game is kept on the low level to which it has gradually fallen in the more densely populated parts. The shooting is, however, of no small value to the landowner, inasmuch as well-to-do *sportsmen*, for their own pleasure, try more and more to obtain the shooting-rights on adjoining lands, against payment of so-called shooting-rents. What the landowner cannot gain by his own shooting he can thus, by letting out his shooting, obtain to an amount often considerably higher than that which the game existing on his grounds really represents.

Though the shooting for individuals can thus be said to be of comparatively slight importance as a source of gain, still the game killed in the whole country represents a considerable capital, which is well worth administering in a practical way. As game, besides, makes a wholesome and nourishing food, which is highly esteemed for its excellent taste, and as shooting is a strengthening and hardening sport for the growing generation, everything seems to indicate that such attention should be paid to the game, that not only is its decrease prevented, but its development, on the contrary, advanced. The interest in an improved preservation of the game is, happily, steadily increasing, and shooting interests are promoted by numerous shooting associations and unions for the protection of game, which have united to attain this object, under the name of "Svenska Jägareförbundet" (Swedish Hunters' Association).

2. FISHING.

Sweden being surrounded to a large extent by the sea and possessing innumerable lakes scattered in its interior, its inhabitants turn their eyes to the waters as the source of a considerable portion of their livelihood. It is true that the increasing cultivation of the country and its industrial development, as well as the great value which its vast forests now have, compared with their former value, have had as a result that fishing is not of the same importance nowadays as it once was for the few and scattered inhabitants of former days. But even to day, fishing has a considerable value as a source of livelihood. In consequence of improved methods of fishing and of the higher price of fish, it is certain more remunerative nowadays than at any previous period. With regard to *the returns of the Swedish fisheries*, we have as yet only scattered and very insufficient information. According to an approximate estimation for the period 1891—95, the annual value will, however, have amounted to about 9 million kronor, of which 4 million come from the coast-fisheries, 1·5 from

Photo. K. A. Andersson.

Purse seine fishing for herring (Bohuslän).

the high-sea fisheries, and 3·5 million kronor from the fresh-water fisheries (including salmon and eel-fishing). The herring-fishery was calculated to produce 2 750 000 kronor, the small (or Baltic) herring-fishery 1 000 000, lobster- and oyster-fishery 175 000, the salmon-fishing 950 000, and the eel-fishing 600 000 kronor. During 1912 the sea- and coast-fisheries of Sweden brought in, in round numbers, 15 million kronor, no less than 8 733 000 kronor of this sum falling to the share of Göteborg och Bohus län.[1] The herring-fishery of the west coast, the trawled herring not included, gave 4 018 000 kronor; the herring and small (Baltic) herring-fishery in the Baltic and the Sound about 2 700 000; the mackerel-fishery of the West Coast 1 963 000 kronor; the trawling-fishery of the same coast 1 478 000 kronor; the deep sea fishery (ling, cod, etc.) 519 000 kronor, and the lobster-fishery about 508 000 kronor. The oyster-fishery was worth no more than 2 735 kronor. During the same year, the eel-fishery along the coasts of Sweden gave about 1 150 000 kronor; the salmon fishery off the coast and in the larger rivers, about 300 000 kronor. The fishery in the largest of the Swedish lakes, Lake Vänern, brought in 687 000 kronor, but it would be a difficult task to give any definite figures for the value of the fisheries in all the Swedish lakes, though the catches during the last few years have probably amounted in

[1] The fishery statistics for this Län is not calculated for the calendar year, but for the period $^{1}/_{4}$—$^{31}/_{3}$ and as above, for 1912—13.

value to about 3 million kronor annually. Table 40 gives returns concerning the import and export of fish.

About 40 000 people live exclusively by fishing, and it also constitutes a more or less considerable subsidiary industry, both for the coast-population and for the agricultural population in the interior of the country.

The Baltic, which washes the east and south coasts of Sweden, is an inland sea containing a low proportion of salt, which decreases from south to north, and, in the Gulf of Bothnia as well as in the inner bays and fiords of the archipelagoes, is only minimal. The salt-constituent of the water increases, however, from the Kattegat northward, and in Bohus Bay, the water of which stands in more direct connection with the North Sea, it is about the same as in this last-mentioned sea. A natural consequence of this fact is that the proportion of salt-water fish is considerably greater there than in the Baltic, where there are but few and they decrease in number towards the north in proportion to the decreasing salt-percentage of the water. But in the Baltic there is another remarkable circumstance, namely, that along the coast, and especially in the archipelagoes, purely fresh-water species occur in equally great or greater numbers than the salt-water species. Thus, of about 40 kinds of Swedish fresh-water fish, no less than 30 species are also found in the Baltic, and some of them are a lucrative source of income to fishermen.

Another circumstance affecting the fishing is that a large portion of the coast is bordered by a fringe of innumerable larger or smaller islands and rocks, forming a so-called "Skärgård".

A consequence of the above circumstances is that the difference between salt-water and fresh-water fishing is less marked in the Baltic than on the west coast of Sweden and in countries surrounded by salter seas. In the Baltic, the Swedish fishery is chiefly *coast-fishing;* on the West Coast and especially in Göteborg och Bohus Län, the fishery is rapidly becoming deep sea fishing. Furthermore, in comparing the fisheries of Sweden with those of other countries, it is worthy of notice that, in Sweden, the boats and fishing-tackle are owned by the fishermen themselves, the members of the crew being part-owners in the boat, and the profits are divided according to the shares owned, after a certain portion has been deducted for keeping the boat in repair. It was only when steam-trawling was introduced on the West Coast some few years ago by shipping- or other companies, that Swedish fishermen were engaged as hired crews.

Salt-Water Fishing.

For the Swedish fishery, **herring** (Clupea harengus) and **small (or Baltic) herring** (Clupea harengus, var. membras L.) are the most important of all Swedish species. Herring-fishing in Bohuslän attracts the greatest attention, both on account of the great proportions which it assumes at certain times, and also because of a peculiar circumstance with respect to the appearance of the herring which has been characteristic of the fishery as far back as history goes. For, after having appeared along the coast and entered the fiords for several decades, the herring has for long periods ceased to enter the Bohus archipelago, where, during these intervals, only the ordinary coast herring has appeared and then but in small numbers in comparison with the good fishing years. Such a period

of prolific herring-fishing on the Bohus coast began in 1877 and continued up to the close of the century. In the middle of the first decade of the new century, after a few years' unsuccessful seine-fishing (vadfiske), the Bohuslän herring-fishery began to flourish again, deep-sea-fishing being commenced with purse seines (snörpvadar), from boats provided with motors. During the last few winters, herring-fishery has been carried on by means of trawling and occasionally at great depths. The existing herring-fishery on the West Coast cannot be compared with any previous herring-fishery period in the old sense of the term. It is possible that, had the two methods of herring-fishing just mentioned been known at an earlier date, successful fishery would have been possible even during the intervals between the good fishing periods in past times. In connection with Table 40 below, the attention of the reader is called to the following list. which shows the amount of fresh fish exported (the greater part consisting of herring) for each of the years in question, from the beginning of the last herring-period. The export was:

Year	Quintals	Year	Quintals	Year	Quintals	Year	Quintals
1877	227	1887	340 960	1897	229 507	1907	414 737
1878	9 536	1888	391 441	1898	396 691	1908	579 862
1879	4 300	1889	558 069	1899	226 344	1909	634 692
1880	11 162	1890	678 184	1900	44 778	1910	459 095
1881	20 346	1891	681 278	1901	102 790	1911	713 522
1882	45 811	1892	907 022	1902	51 619	1912	752 080
1883	43 019	1893	773 848	1903	144 998	1913	351 564
1884	20 252	1894	1 001 344	1904	138 780		
1885	120 965	1895	816 090	1905	331 931		
1886	221 313	1896	677 232	1906	360 181		

Until the beginning of the present century, the herring was caught in Göteborg och Bohus Län partly, and chiefly, by means of land-seines (Sw. stängvadar; landvadar), and also with gill-nets (Sw. sättgarn). In 1880 there also

TABLE 40. *Imports and Exports of Fish.* In Quintals.[1]

Annually	Fresh fish		Herring, salted[2]		Anchovy, sardine, tunny		Other fish	
	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.
1866—70	1 032	277	244 070	1 784	18	12	32 778	1 074
1871—75	1 274	851	285 836	7 090	89	210	37 545	2 328
1876—80	2 324	5 140	222 629	18 950	778	1 014	42 983	2 743
1881—85	6 453	50 079	260 225	45 755	3 380	898	35 116	5 932
1886—90	8 719	437 993	265 027	105 912	6 901	890	38 833	5 938
1891—95	14 162	835 916	307 289	328 583	14 321	966	39 240	6 433
1896—00	21 198	314 910	396 687	123 834	21 289	458	43 460	4 956
1901—05	47 853	154 024	424 553	40 740	22 975	87	50 586	4 585
1906—10	118 316	489 711	425 321	57 887	15 226	1 506	51 168	18 610
1911	89 496	713 522	394 571	69 063	14 118	938	45 614	25 810
1912	88 022	752 080	363 276	73 205	16 600	778	28 566	19 231
1913	81 540	351 564	444 920	72 294	7 001	309	52 045	25 498

[1] For the years 1866—84 a hectoliter of salted herring has been calculated as corresponding to 87 kilograms. — [2] Including tinned, dried, and smoked herring, as well as small (Baltic) herring, sprats, etc.

arose a considerable autumn herring-fishery with drift-nets, which, during August—October, was carried on off Halland and the southern part of the län abovementioned. Fishermen from Skåne too have taken part in this fishery, carrying on their operations in the Kattegat. Like those from Blekinge, these fishermen catch the herring in the Sound and in the south of the Baltic during the summer and autumn by means of drift-nets. The same kind of fishing is also carried on during summer around the island of Gottland. In the bays and fiords of the archipelago, along the coast from Blekinge northward, herring and small (Baltic) herring are fished with seines principally during spawning time in spring and the early part of summer; in some places in Central Sweden, also during winter under the ice with very large seines, so-called winters seines. Besides, there is used a special kind of set herring-nets, which along the Norrland coast are tied very deep and are turned inward in the shape of a hook and are called "hook-nets" or "deep-nets". Fykes, too, are used for fishing small (Baltic) herring in certain parts off the Norrland coast.

Herring is nowadays to a large extent sold fresh, partly for export, especially to the German curing houses, from Bohuslän, Halland, and Skåne, and partly for home use. In years when the herring-fishery was good, large quantities of herring from Bohuslän which were not found worth salting, were used in preparing guano and herring oil. The best herring was salted and, for the most part, exported.

Small (Baltic) *herring* (var. membras) is, when fresh, a delicious fish, and also when salted it constitutes an every-day article of food among the population of Central and Northern Sweden. Small herring is also eaten smoked (bloater).

The real *anchovy* (Stolephorus encrasicholus) occurs only rarely in Swedish waters, but the other species of herring, the sprat (Clupea sprattus), occurs both along the west and the east coast, and is prepared, in Bohuslän, in the salted and spiced form which, in tins labelled "ansjovis", has found a very extensive sale both at home and abroad.

Among the **cod** family (Gadidæ), the following species are extensively fished: the cod proper (Gadus morrhua), the haddock (G. aeglefinus), the whiting, or merling (G. merlangus), the ling (Molva vulgaris), and the hake (Merluccius vulgaris). The *cod* occurs all around the coast all the way up towards Norrland, although in decreasing numbers, but is not so very extensively fished in Sweden as in Norway, although cod-fishing along the west coast and also in the Baltic, all the way up to Gottland does not lack importance. The other species mentioned above belong to the West Coast only. The ling plays an important part in the Bohuslän fisheries, and it is the fish that is caught in greatest numbers in the Bohuslän deep-sea- or bank-fishery, which is pursued in distant waters — near the Shetlands and in other parts of the North Sea. Nowadays, the fishery in question is carried on for the most part with large cutters bought in England, but large motor-boats are also employed. The long-line (Sw. "långrev; backa") is used in this fishery. The old-fashioned "bank-sloops" have quite disappeared. Besides the ling are also caught the cod proper, the torsk (Brosmius brosme), etc. One or, as a rule, several trips are made during the spring and summer.

Later on in the season, many Bohuslän fishermen go with the same class of boats on the **mackerel** fishery, with mackerel-lines (Sw. dörj), in

the North Sea, a fishery which, carried on from small, decked motor-boats, is pursued at an earlier period in the Skagerrak and Kattegat, where, in the early part of the summer, mackerel is caught by means of drift-nets. The Swedish mackerel line fishery in the North Sea, which began in 1884, now ranks in importance next to the herring-fishery. In 1912, the Swedish mackerel-fishery brought in at first hand about 1 892 000 kr. The greater part of the mackerel caught by line in the North Sea is salted and split, and exported to the U. S. A.

Among the **flounders,** the plaice (Pleuronectes platessa) is of the greatest importance for the Swedish fisheries. For the Baltic fishery, however, the common flounder (Pleuronectes flesus), plays the most important role. It is found as far up as in the Gulf of Bothnia. Other kinds of flounder caught in considerable numbers on the west coast are the turbot (Bothus maximus), the brill (Bothus Rhombus), the sole (Solea vulgaris), the halibut (Hippoglossus vulgaris) and the pole-dab (Pleuronectes cynoglossus). The two latter species are found in deep water, where the pole-dab is caught by means of the trawl.

The **lobster** is caught only on the west coast, but, south of Hallands Väderö, not in any considerable numbers. The **oyster** fishery, which, of late years, has fallen off very considerably, is nowadays carried on only in some few firths north of Marstrand.

The **eel,** like the salmon, belongs, it is true, both to salt and to fresh water; as, however, in Sweden, by far the greater part of the eels caught are taken in the sea off the coast, on their autumn migration to the Atlantic, there is good reason to reckon the eel as belonging to the sea-fisheries. The most productive eel-fishery is that carried on with the help of a kind of fykes (eel-traps) called "hommor", on the coasts of Östergötland, Småland, Öland, Blekinge, and Skåne. A fairly lucrative "hommor" eel-fishery exists as far north as Grisslehamn, however. During the last few years (from and including 1907), the fishermen in Skåne have begun to make use of large traps or pound-nets, attached to stakes driven into the sea-bottom and called eel pound-nets (Sw. ålbottengarn), in which considerable quantities of migrating eels are taken during the autumn. Most of the Swedish coast- or migrating eel is exported to Germany, whither it is conveyed by the German cauf-vessels, which make regular visits to the more important eel-fishing centres.

Fresh-Water Fisheries.

As before mentioned, Sweden possesses a great number of large and small lakes, and, in this respect occupies the second place among the countries of Europe, in proportion to its area. Sweden also possesses about 40 **salmon rivers,** of a total length of 9 000 kilometers, 3,700 kilometers of which are accessible to salmon. The "salmon", is found not only in these rivers, but also in the great lakes, Vänern, Vättern, Siljan and Storsjön. The

latter lake is in Jämtland. The salmon occurring in these lakes do not go down to the sea, and, if we except the fish found in Vänern, the are really only large salmon-trout. In the rivers, the salmon are caught in nets and seines, and in various kinds of salmon-traps. The salmon-fishery has fallen off considerably during the last few decades. The most productive river salmon-fishery is that in the Ångermanälven, Indalsälven, Dalälven (the lower part), Mörrumsån, Lagan, Ätran, and Götaälv, and in the Torneå älv, where the fishery is carried on in common by Swedish and Finnish fishermen. Of late years the fishery has gradually removed to the coast, principally in the neighbourhood of the mouths of the rivers, but also out to sea. From Blekinge and Skåne, for example, a fairly lucrative salmon-fishery has been carried on by means of drift-nets and salmon-lines (Sw. uppflötade revar) in the neighbourhood of Bornholm, and even nearer to the German coast. Fishing by means of salmon-lines, however, is nowadays never practised, and, except in Hanöbukten, drift-net fishing, too, is carried on on a considerably smaller scale than before.

Photo. Fr. G. Klemming, Stockholm.

Salmon Fishing at Älvkarleby.

Of far greater economic importance for the country than the salmon are the so-called coarse fish (Sw. fjällfisk, gråfisk), i. e., pike, perch, bass, bream, ide, roach, etc., which, as a rule, form the greater part of the fish caught in the Swedish lakes. In the northern part of the country, in the mountain lakes and in a number of deep lakes resembling mountain lakes, such as, for example, Lake Vättern, there exist a number of salmonidæ, the charr, trout, gwyniad

(Coregonus lavaretus) and grayling, while in the lower-lying lakes the vendace (Coregonus albula) is of paramount importance. All the species of fish mentioned, with the exception of the charr, are also found in the Baltic; the grayling, however, is caught only in the northern part of the Gulf of Bothnia.

The crayfish-fishery, too, in Southern and Central Sweden, is of no little importance. In 1907, however, the so-called "crayfish disease" broke out in Lake Mälaren, with the result that it has exterminated the crayfish in that lake, in Lake Hjälmaren, and in a number of streams and lakes communicating with the waters mentioned.

In general, the lake fisheries of Sweden have not been managed or utilized in a rational manner, but still they have been fairly productive (see above). The average annual yield of the Swedish fresh-water fisheries has been calculated as being no more than about 3 kilograms of fish per hectare, while average lakes in the north of Germany yield 15—30 kilograms. One chief reason of the poor yield of the lake-fishery in Sweden is, that it is carried on and managed in an unsatisfactory manner, for the number of owners of the fishing rights is so great that it is impossible to carry on the fishing in accordance with a uniform and properly organized plan.

Fish Culture.

Sweden is, as far as is known, the first country in Europe where attempts were made to assist the spawning of the common inland lake fish by means of special contrivances, for the purpose of improving the fishing. As early as 1761, the Mayor of Linköping, *K. F. Lund*, published in the "Proceedings of the Royal Academy of Sciences" an essay called "On the Planting of Fish in Inland Lakes", where he gave an account of a method for hatching out perch and other inland lake fish (not salmon idæ) in pens lined with brush. His attemps were afterwards forgotten until about 1850, when attempts at fish-culture were again begun, and it was not until 1865 that a complete institution for salmon-cultivation was established at the expense of the State, whose "normal institution" afterwards became a pattern for a large number of such institutions throughout the country, of which there are now between thirty and forty.

Fish culture in ponds was carried on in ancient times at the monasteries and on many large estates, especially in Skåne, where the *carp* was introduced from Denmark at the beginning of the sixteenth century, but these ponds were afterwards neglected. The culture of carp has been recommenced of late years, and in Gustavsborg in Skåne there is a large number of carp-ponds on the German model, built in 1879. From these ponds about 20 000 kronors' worth of carp was sold as early as in 1896, principally to Germany. The carp, however, thrive as far to the north as Värmland, where experimental carp-breeding ponds were laid down at the Långbanshyttan estate; it appears, however, that carp-culture cannot be carried on so far to the north to much advantage. In the highlands of Småland and north of them, the tench can probably occupy the same position in regard to fish-culture in ponds as that taken by the carp in the southernmost parts of the country. The culture of both these species of fish has received a great impulse since the formation, in 1906, of the fisheries association called the "Södra Sveriges Fiskeriförening". The most impor-

tant experiments with regard to pond fish-culture and lake fisheries, together with the investigations in connection with these subjects, have been carried out chiefly at the experimental fishing and biological station at Aneboda, in the northern part of Kronoberg Län, and partly at Eriksdal, in Malmöhus Län, and the lakes rented around these places by the named association. The fish-culture establishment which was founded in 1894 by a company at Ängelsberg in Västmanland, and the chief end of which was the hatching and further culture in ponds of two members of the salmon family from America, the brook-trout (Salmo fontinalis) and the rainbow-trout (Salmo irideus), has lately been enlarged, the company having erected a system of ponds on ground leased from the State and forming part of the Kloten Crown Park in Örebro Län. The same kind of pond culture has been going on for some years at Källefall in Skaraborg Län, and a company is engaged in similar work at Kälarne, in Jämtland. It is remarkable that the stocking with the above-mentioned brook-charr of lakes so far north as in the neighbourhood of Åre has had very good results. In 1890 there was founded, at the expense of the State, a *Fish Culture and Fresh Water Biological Establishment* at Finspång in Östergötland, with a number of small ponds, as an experimental station for pond fish-culture and fresh water biological investigations. As the supply of water proved to be uncertain, the establishment — in accordance with a resolution of the Riksdag — has been closed and another, larger State establishment, for the culture of salmon, charr, and gwyniad from Lake Vättern, is to be erected at Motala.

Repeated attempts at oyster culture have been made in the coast-archipelago off Bohuslän, the last being in accordance with a new method elaborated by the director of the Swedish Hydrographic-biological Commission. Unlike former attempts, this new effort seems to promise success. The same Commission has also begun experiments with lobster culture, for which the west coast of Sweden offers many possibilities. There is reason to hope that these attempts will succeed, and that they will result in lobster culture on a large scale being carried out on behalf of the State.

Fishery Legislation.

In regard to the ownership of fishing-waters, there were provisions even in our oldest laws and in the Code of 1734, too, but laws for the protection of fishing were not made until late in Sweden, namely the "Common Fishery Law" of 1766. The Fishery Law now in force is of October 17, 1900. The provisions in regard to right of ownership have, however, now been deleted from this law and arranged as a special "Law concerning the Right to Fishing Waters", of June 27, 1896.

Nowadays, the State owns only few fisheries. The majority belong to private persons, according to the common rule that the owner of the shore also owns the water and the fishing; but in the villages that have not undergone repartition (cf. p. 31), this right is only applicable to the villages themselves, while the individual owners in the village have equal fishing rights within the territory of the village. The shore ownership enjoyed by the various villages extends, in lakes, streams, and the bays and fiords of the archipelago, to the boundary-lines. On the open sea-coast and in the largest inland lakes, the shore-ownership extends only 180 meters outward from the shore, measured from a depth of 2 meters; beyond this, the fishing is free to all Swedish subjects. Furthermore, there is the important provision that in rivers and sounds, one third of the width of the

watercourse (in certain cases one sixth) in the deepest place, shall be left free from fishing appliances, unless special privileges to close the water-course have been granted. The same is applicable to dam-buildings. This open central channel in the water-course is called "the King's artery" (kungsadra).

With respect to the fishing economy, only general provisions are made in the Fishing Law, while detailed regulations are left to the local governments in the different läns, which have the right to issue special bye-laws for separate water-courses, including the lakes, or for the whole of a larger or smaller portion of the län, after the hearing of the fishery-owners concerned and the fishery officials. The decision of the authorities can be appealed from to the Government.

The "Law regulating Fishing Rights held in common" (Sw. Lag om gemensamhetsfiske) which was passed by the Riksdag, 1913, aims at facilitating uniform and organized management and utilization of fisheries which are held in sole possession (Sw. oskiftad; cf. above and p. 31), or which belong to two or more persons.

Fishery Administration

has been gradually developed. During the eighteenth century, the care of the fisheries devolved on the Board of Trade. Towards the end of the century, there was appointed, during the great herring-period in Bohuslän, a "superintendent of the herring-fisheries", but when this period came to a close, the post was left unfilled, and the fisheries were long without an official of any sort. About 1850, the authorities in Bohuslän appointed a *superintendent of sea-fisheries* of the province. At about the same time, the Academy of Agriculture appointed an *itinerant teacher in fish-culture, etc.*, and in 1864 a *fishery intendant* with two assistants, who were paid by the State. In 1890, when the administrative duties of the Royal Academy of Agriculture were transferred to a special department, the Royal Board of Agriculture, one of its members was appointed, under the title of *Fishery Inspector*, to take over the principal duties of the fishery superintendent and to be chairman in debates on fishery matters in the Board. The assistants became officials subordinate to the Board.

It was not before 1903 that the superintendence of the sea-fisheries of Göteborg och Bohus Län was transferred from the Board of Trade to the Royal Board of Agriculture. A thorough re-organization of the administration of the fisheries took place in 1904, when, instead of the two fishery assistants and the teacher in fish-culture, it was determined to appoint six fishery intendants, each with his own district to supervize, a fishery assistant, a fishery engineer, and two fishery stipendiaries. At the close of 1912, the posts of the fishery intendents were all filled by permanent officials. In 1885 a State fishery- or commercial fish agency was established in London, which, in 1888, was transferred to Berlin, and, in 1912, transformed into an agricultural expert's office, one of the duties of which is to promote the interests in Germany of the Swedish fish export. Fishery instructors or fishery superintendents are found in the service of most of the Swedish Agricultural Societies and in that of the Gottland County Council, who are paid by these corporations aided by a contribution from the State grant for the support of the fishing industry.

Several other measures have been taken by the State during the last few years for the promotion of the fisheries of Sweden. The loan-fund for the promotion of the fisheries, towards which the Riksdag contributed 100 000 kronor in 1892, has since that date increased to 2 767 250 kronor outstanding means at the close of 1912, 2 100 900 kronor being to the account of Göteborg och Bohus Län, and 666 390 kronor to that of the remaining läns. Since the year 1907 inclusive, a sum of 750 000 kronor annually has been disbursed in

the form of loans. The rate of interest is 3·6 % and the amortizing-period is 10 years at most. The loans, which are granted for the purchase of fishing-boats, motors, and other fishing-gear, or for the erection of small establishments for the utilization in various ways of the products of the fisheries, are negotiated by the Agricultural Societies or the County Councils, who undertake the risk of the loan, which is granted by the Royal Board of Agriculture or, in the case of Göteborg och Bohus Län, by the Governor of the län. The fund in question has been made full use of, and has greatly contributed to the development of fisheries of late years, especially as regards the sea-fisheries.

In 1911, the Riksdag granted 2 788 000 kronor for the erection of fishing-harbours and in the years 1912—14 a total sum of 210 000 kr. more for the same purpose. Since the year 1905 a State grant has enabled the Royal Board of Agriculture and the Central Meteorological Office to issue storm-warnings to the west and south coasts of the country, to the great benefit of the fisheries. In 1914 the storm-warning-service was extended to the east cost. By a Royal Ordinance, dated October 2, 1908, the State Insurance Office took measures specially for the insurance of fishermen against accidents. From 1903 inclusive, partly by means of a State grant and partly by means of grants from the Agricultural Society and the County Council of the Län, courses of instruction in navigation have been arranged for the fishermen in Göteborg och Bohus Län. From and including 1901, a yearly sum of 7 000 kronor has been granted for division between the Agricultural Societies and the County Councils, on condition that these corporation contribute an equal amount, the money to be awarded as bounties for killing seals and thus, in some measure, to lessen the loss caused to the fisheries by the animals in question. Since the beginning of 1914 the State alone pays those bounties — 4 kr. for each seal killed. As the number of seals killed yearly off the coasts of Sweden amounts to about 7 000—9 000 kr., the amount to be paid in these bounties will probably be about 28 000 36 000 kr. In the international measures which have been taken in common for the investigation of the northern seas, for the benefit of the fisheries and for scientific purposes, and the initiative to which was given by Sweden in 1899, this country has ever since taken an active part, and a special commission has been appointed for the direction of the share of the investigations which has fallen to the lot of Sweden. During the last few years this commission has received an annual grant of 21 000 kronor, of which sum 5 100 kronor is to help to cover the common international expenses. An annual grant of 34 000 kronor is made for the investigating- and guard-vessel, specially built for the work, which has been in use since 1905. For a great number of years back another Crown vessel has also been stationed on the west coast for the protection and necessary assistance of the fisheries there.

In 1908, the Riksdag granted a sum of 29 000 kronor for a vessel to be employed in fishery experiments and investigations in the Baltic and the Swedish lakes entrance to which can be obtained from the sea in question. An annual grant of about 8 500 kronor is now made for the up-keep of the vessel — a large motor-boat.

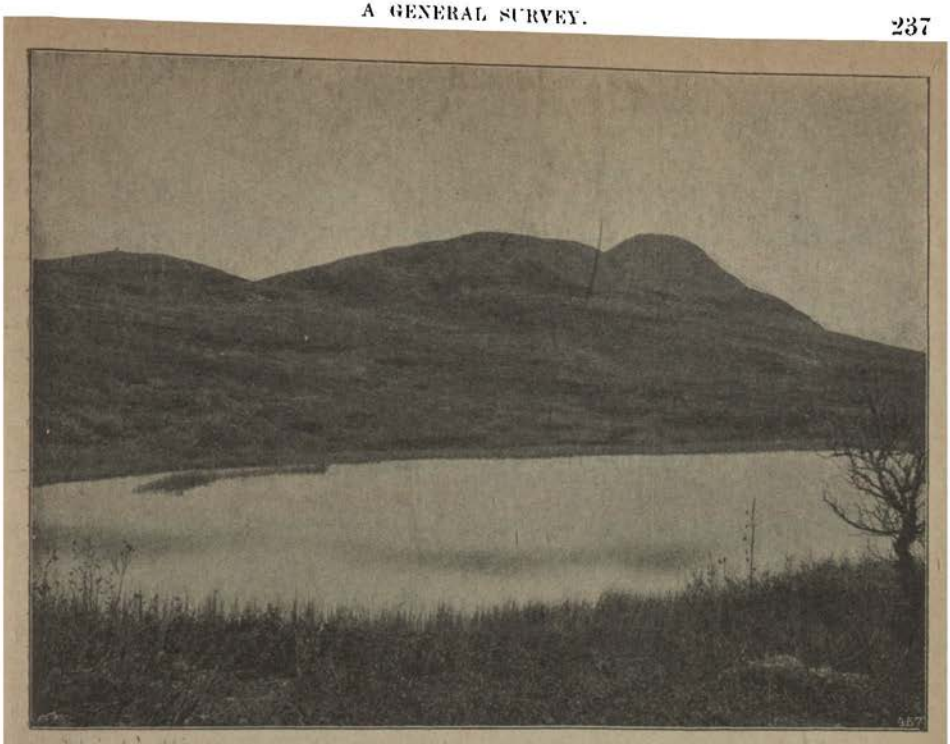
VI.

MINING AND METALLURGICAL INDUSTRY.

A General Survey.

Mining is a very ancient occupation in Sweden: it has assumed for centuries and still maintains a front rank position among her industries. The fame of Sweden's mineral wealth, particularly in copper and iron, penetrated at an early date to foreign countries, and her metallurgists have a reputation from of old for masterly skill at their craft. It may be said without exaggeration that Swedish steel and iron have conduced more than anything else that comes from Sweden to make her known to the world; and they are still finding their way to all the countries of the globe.

The origin and continued existence of the Swedish metallurgical industry is based primarily on the rich and once easily accessible supplies of ore, which, moreover, as far as the iron ore is concerned, are, as a rule, of great purity; but also the plentiful supply of timber and of easily equipped water-power have been factors of great importance. Utilization of these natural advantages led to the result that Sweden came to be the world's biggest producer of copper (17th century), and afterwards of iron (18th century). However, she was unable to maintain this position in the long run. The enormously increased demands for metals gave rise to new metallurgical processes, and led to the discovery of new and large supplies of ore in different parts of the world. A great revolution was brought about by the employment of stone coal in lieu of charcoal: Sweden, being poor in fossile fuel, was unable to make use of the new method. This method, however, only permits of the fabrication of a product of ordinary quality, and, as iron and steel of the highest quality could not, and cannot now, be dispensed with, the Swedish iron industry has nevertheless appropriated a market of its own, which it has contrived to maintain, in

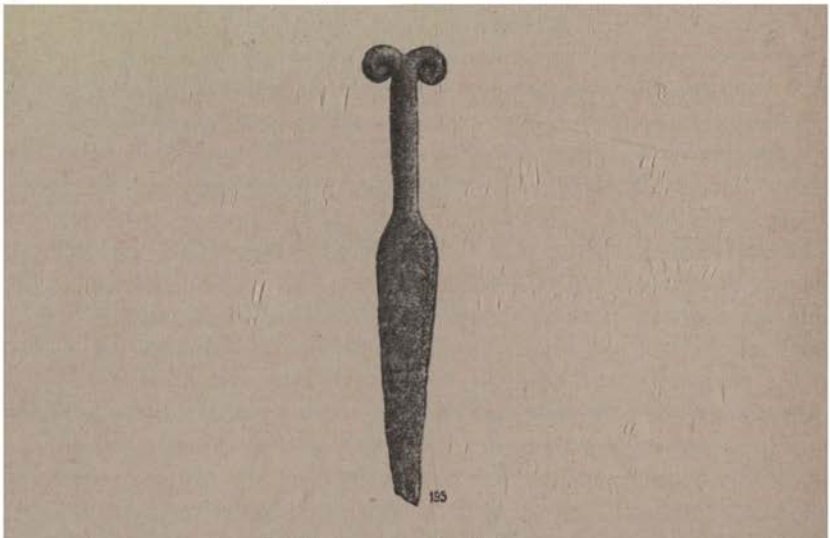


Mt. Kirunavara.

spite of improvements in metallurgical processes and higher standards of quality.

The metals and alloys — gold, bronze, iron, silver —. which were first used in Sweden were imported in a metallic state. Processes. however, such as casting, forging, and so forth, were carried on in Sweden at a very early date. According to Montelius, the oldest iron object found in Sweden the date of which could be definitely determined, belonged to the fifth period of the Bronze Age, that is to the 9th and 8th centuries B. C. Soon afterwards iron objects in the subterranean finds become as plentiful as those of bronze, and the beginning of the Iron Age in Scandinavia is assigned by Montelius to about 700 B. C. How long a period elapsed before the ancient Swedes learnt to reduce iron out of ore is not known. The frequently occurring heaps of slag and other remains of primitive smelting have in fact been very little investigated. Montelius, however, is inclined to the belief that this knowledge was acquired soon after iron had come into general use. The date must accordingly be assigned to about the commencement of the Iron Age, or, approximately, 2 500 years ago. It seems certain that ancient metallurgy in Sweden was first directed to the production of *iron*, and made use of lake and bog ore as a raw product. The method of smelting was extremely rude: it was carried out in little pits in the ground, often formed into a kind of furnace by

stones being set up around it. Out of this primitive type of furnace were then developed Osmund "skällingar" and hearths of different kinds and sizes. Osmund, that is, malleable iron produced direct, and also steel were the sole products of the Swedish metal industry for centuries. *Copper* seems scarcely to have been manufactured in Sweden before the Middle Ages, but at all events not later than the 13th century. *Silver* and *Lead* began to be extracted in the course of the 15th century, perhaps earlier. *Gold* was found in Sweden in 1636, and there have been preserved samples of Swedish gold from the year 1695. *Zinc* was experimentally extracted for the first time in 1741, when also brass was made out of exclusively Swedish metals. *Cobalt* began to be exploited in Sweden in 1745. *Nickel* was reduced on a manufacturing basis for the first time in 1839, on a larger scale in 1844. *Manganese* ore was utilised as long ago as the 17th century, but it was not till 1868 that a metallurgical extraction of the metal by the production of spiegel iron commenced. *Chromium* and *Tungsten*, finally, are also Swedish metals; they have been extracted in Sweden from ores since 1892 and 1910 respectively. *Mercury* was temporarely manufactured as a by-product at Sala in 1907. It is not known, even approximately, when the mining of ore first began: probably at the beginning of the Middle Ages, perhaps earlier. Coal mining in Skåne is mentioned for the first time in 1571. Traces of mining of far older date have been discovered in the chalk deposits in Skåne, where flint was mined — perhaps as early as the Stone Age — by the sinking of shafts and stoping. Written records relating to Swedish mining are not found till late, and the early history of mining in Sweden is scanty in data. The earliest information on this subject is apparently to be gathered from the old "sagas". The dwarf smiths who forged famous



Miniature Sword of Iron.
From the 5th period of the Bronze Age Discovered at Bjärsgård in Skåne.

swords and won fame in their craft doubtless not merely fashioned and tempered the weapons, but also knew the still greater art of producing a good steel material out of ore. The oldest mining records preserved are a document from the year 1288, relating to a share in Stora Kopparberget (Great Copper Mountain), a deed of transference of the year 1303 dealing with a share in the iron mountain of Norberg, a mining statute of the year 1340 concerning "Västra Berget" (West Mountain), and a deed of privilege of the year 1347 referring to Stora Kopparberget. In 1461 is mentioned a blast furnace in Närke. However, it was not till the 16th and 17th centuries that the blast furnace process came into general use in Sweden.

The later development of Swedish mining and metallurgical science was on the whole influenced by Swedish conditions and requirements, though investigations and inventions of wider scope are not lacking. The early felt need of quality and the consequent endeavour after a profounder knowledge of the essential nature of the processes employed, explains how scientific metallurgy came to be elaborated earlier in Sweden than in other countries. Within this sphere Swedish mining and metallurgy from the 18th century down to the present day can boast of quite a series of eminent scientists. Work prolific in results has been done in Sweden, to determine the chemical composition of iron, to ascertain the physical properties of iron and steel, to master the processes employed in roasting kilns, blast furnaces, hearths and so forth, and to study the right treatment of steal. New methods of quantitative analysis have also been elaborated from time to time by Swedish scientists: several of these methods have been adopted in all the iron-producing countries.

Passing to the technique of mining and metallurgy, it should be noticed that dynamite, the far-reaching importance of which has been universally recognised, is a Swedish invention. The Bessemer process, the most ingenious of refining methods, has been developed to the point of effeciency in Sweden. This process, like others of foreign origin transplanted to Sweden, has been improved there and adapted to Swedish requirements. The ore-roasting process has been successfully handled by Swedish metallurgists, and solutions of the problem have been attained in several different ways: the latest is the Ramén-Beskow furnace intended for the manufacture of copper; this furnace is also extensively used abroad. — Two other old problems, the briquetting of pulverised ore, and the direct production of soft iron, have also been solved, for certain specific purposes, in Sweden, the former by the Gröndal process of briquetting the iron ore without the use of binding mediums, and the latter by the reduction of ore into sponge iron with inferior fuel, in accordance with Sieurin's method. The first practical electric blast furnace, as is generally known, originated in Sweden, and several electric steel furnaces — among them the remarkable Kjellin furnace — have also been constructed there. The first iron works driven throughout by electricity are also Swedish. An electric process

TABLE 41. *The Mining of certain Minerals in Sweden.*

Ores and other minerals.	Annually 1886—90 tons	Annually 1891—95 tons	Annually 1896—1900 tons	Annually 1901—05 tons	Annually 1906—10[6] tons	Year 1912 tons
Iron ore	932 470	1 519 325	2 294 760	3 564 046	4 626 913	6 700 565
Copper ore	20 266	23 941	23 590	33 306	15 237	3 059
Silver and lead ore	14 754	16 552	8 644	9 424	2 081	2 877
Zinc ore	53 402	48 315	57 701	54 971	47 345	50 036
Manganese ore[1]	8 977	6 090	2 487	2 330	4 519	5 101
Nickel ore	495	97	—	—	—	—
Cobalt ore	190	79	—	—	—	—
Gold ore[2]	1 129	1 809	1 511	—	—	—
Iron pyrites[3]	1 319	853	448	14 837	24 012	31 835
Stone coal	176 516	203 390	235 626	308 000	291 424	360 291
Refractory clay	98 063	129 295	130 912	159 348	117 339	135 773
Clinker clay[4]	—	24 765	35 541	57 339	58 622	58 846
Felspar[5]	—	—	16 813	17 619	19 223	34 305
Total tons	**1 307 581**	**1 974 511**	**2 808 033**	**4 221 220**	**5 206 715**	**7 382 688**

[1] Manganiferous iron ore is included in iron ore. — [2] The figure 1 511 tons is the average for the years 1896—98. — Auriferous copper ore is included in copper ore. — [3] The figure 14 837 tons is the average for the years 1903—05. During the years 1901—02 no iron pyrites was mined — [4] Data are lacking for earlier years. The figure 24 765 tons is the average for the years 1894—95. — [5] Data are lacking for earlier periods. — [6] The General Strike in 1909 depressed mining considerably.

for the manufacture of ferro-silicon, combined with the extraction of potash out of silicates has recently been invented and tested in Sweden. For the production of zinc there is a Swedish electric method in use at Trollhättan. Finally the manufacture of cannons out of *unhammered* steel at Bofors is a proof as good as any of the excellence of the Swedish steel material and the skill of the Swedish metallurgists.

Mining in the stricter sense of the word (thus excluding the stone industry, limestone quarrying, etc.) has yielded in Sweden since 1886 the following quantities of useful products.

TABLE 42. *Import and Export of Unwrought Minerals and Metals.*

Annually	Import. Value in thousands of Kronor				Export. Value in thousands of Kronor				In percentage of the total	
	Coal and coke	Other minerals	Metals	Total	Iron ore	Other minerals	Metals	Total	Import	Export
1871—75	13 452	5 304	9 542	**28 298**	251	826	46 409	**47 486**	11·48	23·22
1876—80	12 719	5 635	9 306	**27 660**	196	1 217	34 513	**35 926**	10·31	17·12
1881—85	15 847	8 048	8 614	**32 509**	284	1 463	40 645	**42 392**	10·24	17·40
1886—90	22 560	9 038	9 300	**40 898**	970	3 226	34 523	**38 719**	12·19	14·20
1891—95	29 770	10 855	9 003	**49 628**	4 241	4 890	30 995	**40 126**	14·11	12·61
1896—00	53 494	15 758	17 931	**87 183**	10 962	7 582	40 459	**59 003**	19·27	16·45
1901—05[1]	58 721	21 820	22 530	**103 071**	20 469	10 470	41 194	**72 133**	19·32	17·57
1906—10	65 540	25 032	33 842	**124 414**	33 237	13 074	51 680	**97 991**	19·29	19·01
1911	61 654	27 749	36 792	**126 195**	51 413	17 632	58 996	**128 041**	18·11	19·29
1912	78 186	55 683	38 658	**172 527**	59 719	21 320	47 903	**128 942**	21·98	16·95

[1] Prior to 1905 the price of coal appears to have been estimated too high.

The above table shows very clearly the great advance that has been made by iron ore mining in Sweden. The coal mines in Skåne also exhibit a considerable increase. The mining of felspar and of iron pyrites has likewise augmented: the development in the latter case is due to improved furnaces, which permit of poor iron pyrites being utilised to advantage. Gold and silver ores, on the other hand, show diminishing figures throughout. The value of the raw products which figure in the above table amounted for the year 1912 to 57 356 770 kronor.

Metal manufacture and *the further working of metals* in metallurgical works showed for the year 1911 a value of production of approximately 134 mill. kronor: out of this total about 120·5 mill. kronor fell to iron alone.

The import and export of the products of the mining and metallurgical industry is figured according to value in Table 42.

The import figures in the table deserve to be particularly noticed. It will be seen that, in spite of the utilization of water power on a large scale during the last few decades and the consequent diminished demand for coal for the generation of power, the import of coal has nevertheless greatly increased. The same has been the case with the other crude minerals and unwrought metals. All these facts taken together attest the increased demand for raw products entailed by the growth of industrial enterprise: but they also suggest the query whether much of what has been imported could not have been produced within the country itself. The coke iron works which are being erected at Oxelösund for the manufacture of 50 000 tons anually of foundry pig iron signifies a step in the right direction. The export figures in the table show what an important part is now played by the export of iron ore. Thanks to the total sum of close on 51 $^1/_2$ million kronor which came into Sweden in return for iron ore during the year 1911, the articles which figure in the table show for that year a balance of 1·8 million kronor in favour of export.

The sub-joined accounts of the different sections of the Swedish mining industry are arranged in order as follows:

1. Mining.
2. Iron and steel industry.
3. Production of other metals.
4. Measures for the promotion of mining.

Gripenhielm's Ducat.
Commemorative medal struck out of the first gold obtained in Sweden, in 1695.

1. MINING.

Iron Ore Resources.

Swedish ore deposits occur principally within two separate districts; in the southerly part of the country in the district known as "Mellersta Sveriges Bergslager" (Mining District of Central Sweden), and in its most northern region, Lappland.

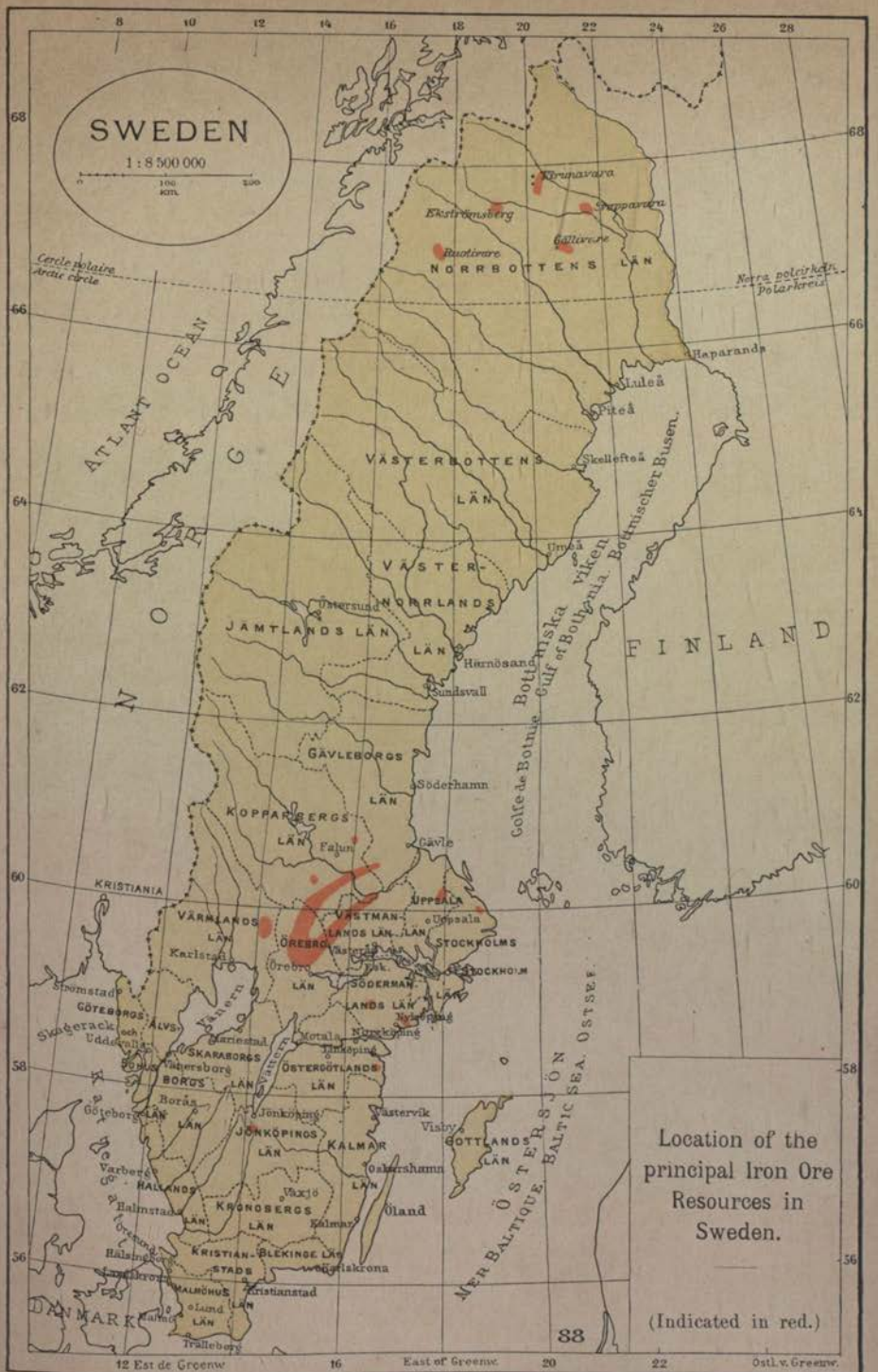
The first-named of these districts is situated between the 59th and 61st degrees of Latitude and between 14° and 19° East Longitude from Greenwich. It comprises the läns of Stockholm, Uppsala, Södermanland, Västmanland, and Örebro, the easternmost part of the län of Värmland and the southernmost parts of the läns of Stora Kopparberg and Gävleborg, or the region between the southernmost part of the Gulf of Bothnia in the East and north of Lake Vänern in the West. This area is about 15 000 square kilometers. Within this region are found the world-famed ore deposits of *Dannemora* and *Grängesberg*. Other important deposits which belong to this district are those of *Norberg, Riddarhyttan, Stripa, Strassa, Striberg, Dalkarlsberg, Persberg and Finnmossen*. Outside the rayon of this districts there are only minor deposits in Southern and Central Sweden. The biggest of these is the titaniferous iron ore deposit at *Taberg* in the län of Jönköping.

The Lappland ore deposits are mainly situated North of the Artic Circle within the parishes of Gällivare und Jukkasjärvi in the north-western part of the län of Norrbotten between the 67th and the 68th degrees of Latitude and between 19° and 22° East Longitude from Greenwich. Within this region, which has an area of about 8 000 square kilometers there occur the biggest iron ore deposits in Sweden, namely *Kirunavara* and *Gällivare*, from which for some twenty years a considerable export of ore has taken place; *Tuolluvara*, and the fields of *Luossavara, Svappavara, Leveäniemi, Ekströmsberg, Mertainen*, etc., which have not yet been worked. Outside of this area the only iron ore deposits of any importance that occur in the North of Sweden are those in the parish of Kvikkjokk at 67° North Latitude 17° 35' East Longitude from Greenwich, where there is a big deposit of titaniferous iron ore at *Ruoutevare*.

All the iron ores referred to above are rock-ores and consist of magnetite or hematite or both, more or less intimately mixed with quartz, limestone or so-called skarn (gangue). The "skarn" consists of lime-magnesia-alumina-silicates: amphibole, pyroxen, granate, chlorite and others. From practical metallurgical point of view the Swedish iron ores are divided into three groups:

"*torrstenar*" (quartz ores), ores requiring the addition of flux making bases;

"*engående malmer*" ("skarn"-ores), smelting in the blast-furnace without any flux, and



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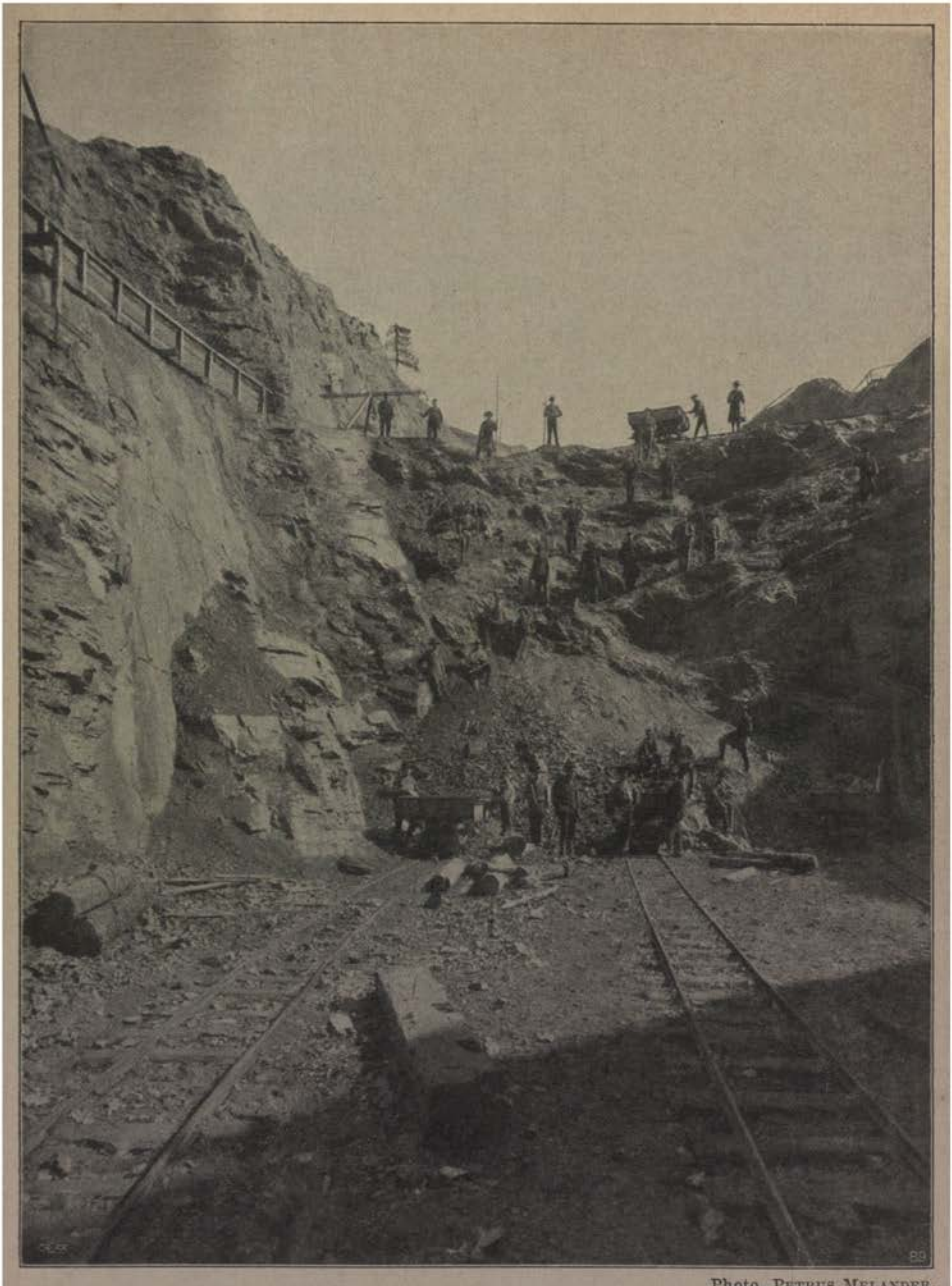


Photo. PETRUS MELANDER.

Open Cut Mining, Gällivare.

"*blandstenar*" (limestone-ores) rich in lime used to make suitable charges by mixture with the quartz-ores.

From mineralogical point of view the Swedish iron ore are dividid into two groups;

"*svartmalmer*" (magnetic iron ores) and "*blodstenar*" (hematites).

With regard to the different qualities of ores the Swedish iron ores are divided as follows:

ores low in phosphorus, with less than 0·01 % of phosphorus, for high-quality production by the acid Bessemer and Martin processes,

ores moderate in phosphorus, with a phosphorus-content exceeding 0·01 % but less than 0·06 %, suitable for refining by the Lancashire process, and

ores rich in phosphorus, with more than 0·06 % of phosphorus, available only for refining by basic processes.

The Swedish iron ores are as a rule titanium-free or very low in titanium. Only at Taberg in Småland and at Ruoutevare in Lappland as well as in a few other minor deposits there occurs ore rich in titanium.

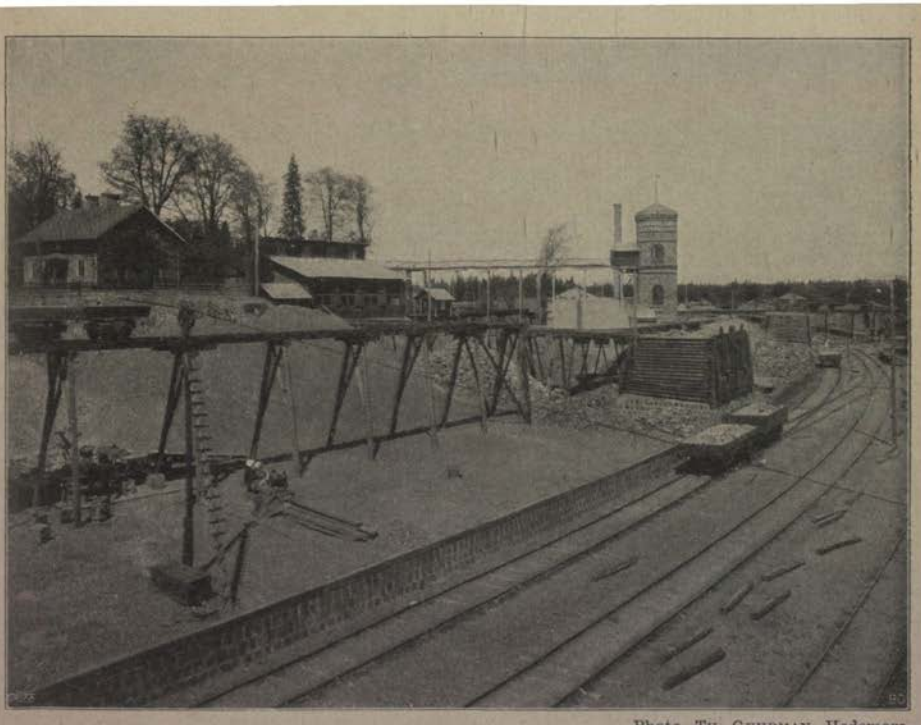


Photo. TH. GEHRMAN, Hedemora.

Shaft Head-house and Ore Bins, Klackberg Mine, Norberg.

In the mining districts of Central Sweden there occur both magnetic iron ores and hematites; the latter are, as a rule, "torrstenar", whereas the magnetic iron ores are principally "engående" och "blandmalmer". In Central Sweden the ores in most of the deposits are low, or moderate, in phoshorus; however, Central Sweden has also large supplies of ores rich in phosphorus with about 1 % of phosphorus, as, for instance, at Grängesberg and its vicinity.

In the Lappland ore fields magnetic iron ore occurs in predominant quantities, although hematite also occurs in considerable quantities, as at Gällivare, Svappavara, and Ekströmsberg. The ore of the Lappland ore fields is generally high in phosphorus, from 1 to 3 %, and upwards, but there also occur ores low in phosphorus in several of the ore fields (as, for instance, at Gällivare, Kirunavara, Tuolluvara, Leveäniemi, Mertainen).

All the Swedish rock-ores belong to the Archaean system. The titaniferous ores occur exclusively in the form of basic segregations in gabbro rocks. The other iron ores appear as a rule as steeply dipping bed-, lens- or stockformed masses, striking in conformity with the surrounding rock, either directly enclosed in these or surrounded by more or less thick masses of "skarn" or limestone. The iron ore deposits rarely occur isolated: as a rule there are several ore beds, ore lenses, or ore stocks more or less close to each other, forming orefields (*malmfält*) of greater or less extent.

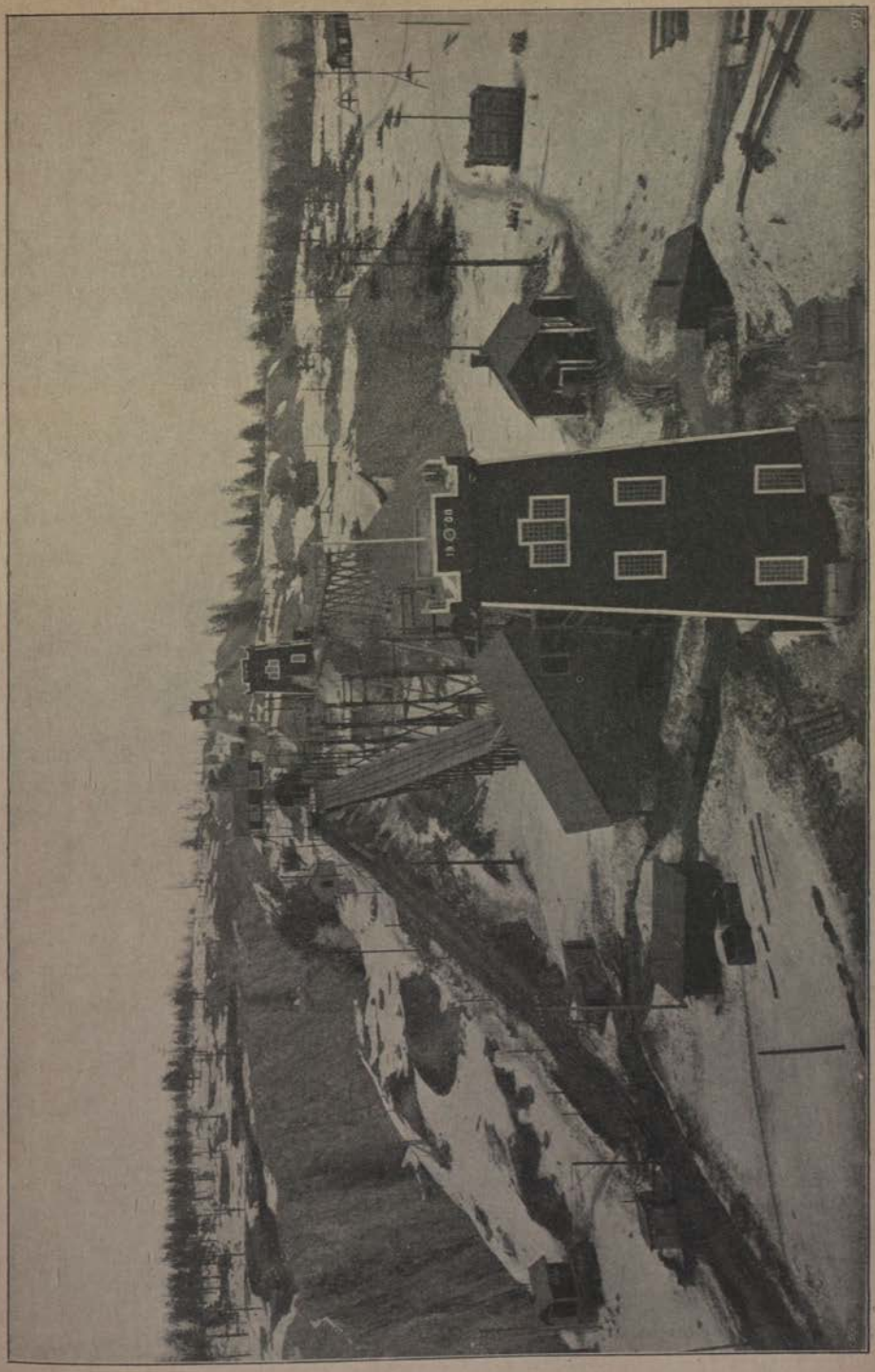
In addition to the rock ores, there also occur, though in a comparatively small quantities, *lake* and *bog ores*, deposits of impure iron-oxide hydrates or iron carbonates. These lake and bog ores, which in olden times played quite a considerable role in the Swedish iron industry, are nowadays employed in but very small quantities, for the production of cast pig iron, principally in the läns of Jönköping and Kronoberg. In 1913 the total output of lake ore raised in Sweden was not more than 3 822 tons.

The percentage of iron in the Swedish iron ore is as a rule rather high, and this is specially the case with the Lappland ores. It has been estimated that the iron ores of Sweden contain on an average about 60 % of iron. By way of comparison it may be interesting to note that the average iron-content for the rest of Europe has been estimated at 36·7 %, and for the whole world (including Sweden) at 44·5 %.

In 1913 over 69 % of all the prime ore which was produced in that year in Sweden showed an iron-content exceeding 60 %, or on an average 63·4 %.

In several mining fields there are obtained along with the picked ore varying quantities of ferriferous rock with too low a proportion of iron to be available for direct smelting. This ferriferous rock, which was formerly considered quite worthless, is nowadays in many mining fields subjected to concentration *(anrikning)*, whereby out of a raw material containing from 25 to 50 % of iron are yielded products, called "slig" (concentrate) with a high percentage of iron, as a rule fluctuating between 60 and 71 %. As the concentrates are obtained in the form of slime, and are thus hardly suitable for the blast furnace process, they are made at a number of works into *briquettes*. By the introduction of the concentrating processes, which in Sweden dates from about 1898, it has in fact been possible to utilize a number of deposits which were formerly regarded as too poor in iron.

The dimensions of the Swedish iron ore deposits vary within wide limits. In Central Sweden the thickness of the middle-sized deposits amounts from 5 to 10 m, and the length to some hundred meters. At the larger ore fields the thickness of the ore body in this part of the country is as much as 20 to 30 m, and in two places, Grängesberg and Stråssa they amount to as much as 90 to 110 m resp., the respective lengths of the bodies are here 400 and 200 m. A continuous body of ore occurs at Norberg to a length of 1 200 m and at Grängesberg to a length of 1 000 m. The whole serie



Shaft Head-houses, Gällivare.

of ore-bodies, following each other, the strike-direction *(malmstreck)*, have for example, a length of close on 20 000 m at Norberg, of 4 000 m at Grängesberg, of 3 500 m at Riddarhyttan, and of 2 000 m at Dannemora.

The ore deposits of Lappland, as a rule, have larger dimensions than those of Central Sweden. Thus the ore deposit at Kirunavara has a thickness of from 20 to 196 m or on an average 50 m along with a length of 3 000 m; at Gällivare there occur thicknesses of up to 100 m, and at Ekströmsberg thicknesses of from 22 to 52 m with lengths of 1 200 m. The vein at Luossavara-Kirunavara has a length of about 7 500 m, and the vein called "Stora malmen" at Gällivare has a length of 5 000 m.

The titaniferous ore deposits are somewhat irregular in their occurrence: out of the two above-named deposits of this kind the Taberg ore deposit has a length of 900 m and a breadth of 360 m, and Ruoutevare has a length of about 1 600 m and an average breadth of about 200 m.

An index of the size of the various ore deposits is afforded by the "ore area" *(malmarea)*, that is the size of the horizontal section of the ore body. The subjoined figures give the ore area of the biggest Swedish ore deposits according to the latest investigations.

Central Sweden.

Grängesberg	94 000	sq. m	
Norberg	50 900		
Håksberg	44 000	»	
Stråssa	26 400	»	
Blötberget	15 000	»	
Dannemora	12 000	»	
Iviken	12 000	»	
Idkerberg	10 000	»	
Riddarhyttan	8 500	»	
Klacka-Lerberg	8 000	»	
Ickorrbotten	8 000	»	
Stripa	7 500	»	
Pershyttan	6 000	»	
Vintjärn	5 800	»	
Fredmundberg	5 500	»	
Persberg	5 200	»	
Kantorp	5 000	»	
Nyberget	ca. 5 000	»	
Utö	5 000	»	
Taberg	260 000	»	
Other Mining Fields	71 000	»	664 800 sq. m

Lappland.

Kirunavara	436 000	sq. m	
Gällivare	230 400	»	
Svappavara	50 000	»	
Ekströmsberg	50 000	»	
Leveäniemi	32 000	»	
Luossavara	25 000	»	
Tuolluvara	14 800	»	
Ruoutevare	135 000	»	973 200 sq. m
		Total	**1 638 000** sq. m

To this total ore area falls to be added the area of the numerous ore deposits in Sweden which for various reasons are not being worked.

Iron Ore Output in Sweden.

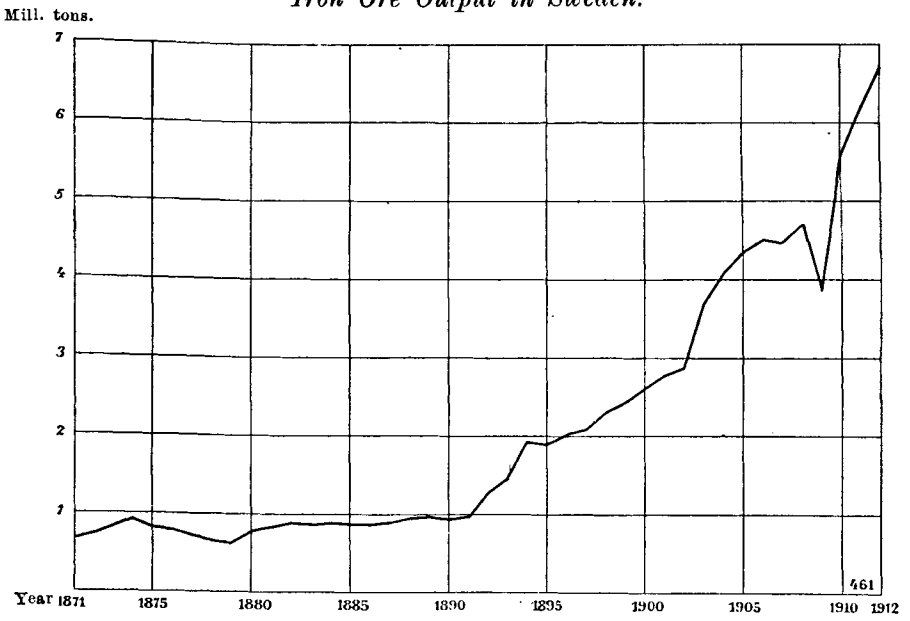
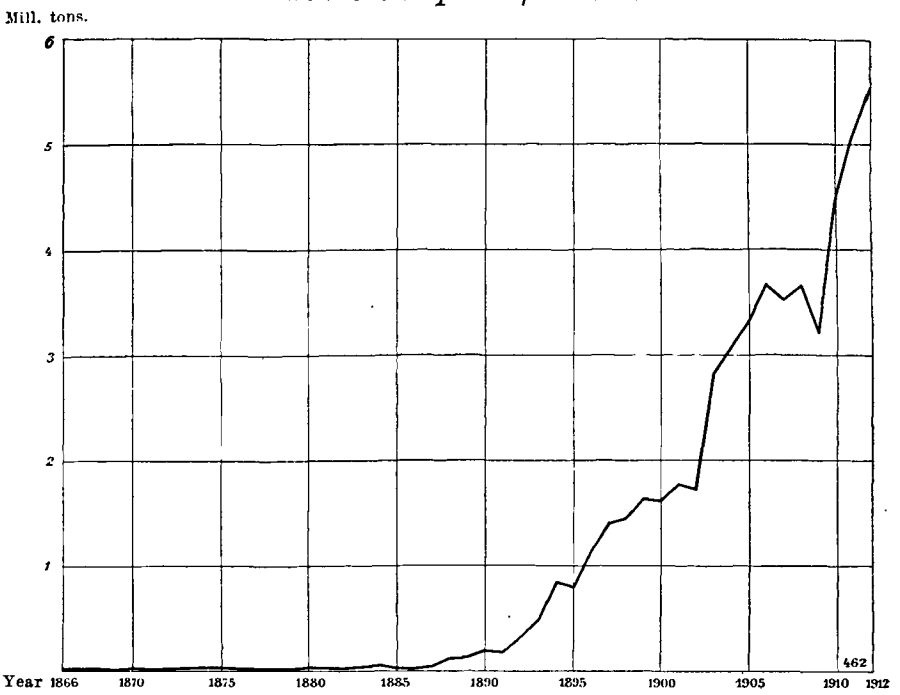


TABLE 43. *Sweden's Supplies of Iron Ore.*

	Lump ore	Concentrating ore	Equivalent concentrate	Total of Lump ore and concentrate
Central Sweden.	tons	tons	tons	tons
Ores with less than 0·01 % of phosphorus	19 400 000	45 500 000	28 000 000	**47 400 000**
Ores with 0·01—0·06 % of phosphorus	11 500 000	6 100 000	2 900 000	**14 400 000**
Ores with more than 0·06 % of phosphorus	59 300 000	2 000 000	1 200 000	**60 500 000**
	90 200 000	**53 600 000**	**32 100 000**	**122 300 000**
Reserves of unperfectly known deposits	40 000 000		—	(40 000 000)
Titaniferous ore (Taberg)		50 000 000	15 000 000	**15 000 000**
Lappland.				
Worked mining fields:				
Kirunavara and Luossavara	758 000 000	—	—	
Tuolluvara	7 000 000	—	—	
Gällivare	270 000 000	—	—	**1 035 000 000**
Svappavara	30 000 000			
Leveäniemi	30 000 000			
Ekströmsberg	50 000 000			
Mertainen	5 000 000			**115 000 000**
Titaniferous ore (Ruoutevare)			8 000 000	**8 000 000**
Total tons				**1 335 300 000**

Iron Ore Exports of Sweden.



Swedish iron ore mines are, as a rule, not very deep, only 7 mines have the mining operations carried down to a depth of 300 m and over, and only in one of them to a depth of 500 m. In none of these places the ore has been different in composition from that at higher levels, nor has as a rule been found that the dimensions of the ore deposit have decreased in the depth. On the other hand, a number of minor deposits have pinched out at comparatively small depths.

In a number of deposits, particularly in Lappland, diamond drillholes have been sunk in order to investigate the depth of the deposit. Thus at Kirunavara ore of considerable thickness has been shown for instance at a depth of 540 meters below the foot of the mountain or 300 meters below the level of Lake Luossajärvi situated at the foot of the mountain, and at Gällivare it has been ascertained, even by diamond boring, that both the "Tingvallskulle" ore and the "Fredrika" ore have the same thickness at a depth of 240 meters as in the outcrop.

A computation of the supplies of ore in Sweden was made, for the account of the International Geological Congress at Stockholm in 1910 by the Geological Survey of Sweden as regards Central Sweden, and by Hj. Lundbohm and Walfr. Petersson as regards Lappland.

This investigation has yielded the results, given in Table 43.

Because the high percentage of iron in the Swedish ores alluded to above, these supplies of ore have been estimated to correspond to 845

million tons of iron, of which 750 million tons fall to the ore fields of Lappland.

Output and Export of Iron Ore.

The annual amount of *iron ore mined* in Sweden during the last decades figures out as follows:

Annually	Tons	Annually	Tons	Annually	Tons
1833—40	235 000	1876—80	726 712	1906—10	4 626 913
1841—50	270 000	1881—85	877 408		
1851—60	349 000	1886—90	932 470	1911	6 150 718
1861—65	464 363	1891—95	1 519 325	1912	6 699 226
1866—70	553 759	1896—00	2 294 760	1913	7 475 571
1871—75	795 263	1901—05	3 564 046		

The output of ore in Sweden for 1912 was 6 699 226 tons. As the total output for the world in the same year may be computed at 157 million tons, it follows that Sweden's contribution was about 4·3 %.

Table 44 gives a conspectus of the relative share taken by the different provinces in the output since the beginning of the nineties of the last century.

Thus, out of the ore at present mined in Sweden about 65 % fall to the Norrbotten mining fields and about 35 % to the mining districts of Central Sweden, out of these 35 % about 19 % proceed from Kopparberg län, 7·5 % from Örebro län and 4·6 % from Västmanland län.

Over 69 % of all the prime ore produced in the course of the year 1913 exhibited an iron-content of between 60 and 70 %; the bulk of it was produced in the big ore fields in the län of Norrbotten and at Grängesberg in Kopparberg län. Further 82·9 of the annual output contained at least 0·1 % of phosphorus, the bulk of which came from Norrbotten län and Grängesberg, whereas the ores of Central Sweden were mostly poor in phosphorus, having a phos-

TABLE 44. *Relative Shares of the Provinces in the Output of Iron Ore.*

Län	Percentage of Output in the whole of Sweden, annually										
	1891—1895	1896—1900	1901—1905	1906—1910	1907	1908	1909	1910	1911	1912	1913
Stockholm . .	1·39	0·95	1·23	0·97	1·00	1·09	1·09	0·81	0·75	0·70	0·62
Uppsala . . .	4·44	2·55	1·74	1·19	1·23	1·23	1·29	1·07	0·96	0.95	0·83
Södermanland	1·58	0·96	0·70	0·62	0·73	0·60	0·65	0·49	0·54	0·53	0·62
Östergötland .	0·20	0·07	0·05	0·07	0·11	0·07	0·08	0·02	—	0·01	0·05
Jönköping . .	0·06	—	—	—	—	—	—	—	—	—	—
Malmöhus . .	—	—	—	—	—	—	—	—	—	—	0·18
Värmland . .	5·63	3·42	2·35	1·65	1·71	1·67	1·81	1·30	1·31	1·09	0·81
Örebro	19·18	12·98	9·16	8·25	8·06	8·89	8·38	8·10	7·31	8·23	7·47
Västmanland .	12·40	8·61	6·34	4·91	4·99	4·83	5·18	4·73	4·72	5·23	4·62
Kopparberg . .	31·09	34·26	25·85	21·36	22·70	21·37	20·17	19·95	19·16	19·24	18·76
Gävleborg . .	0·68	0·40	0·41	0·27	0·37	0·24	0·15	0·23	0·26	0·33	0·31
Västernorrland	—	—	—	0·01	—	—	—	0·02	—	—	—
Västerbotten .	—	—	—	—	—	0·02	—	—	—	—	—
Norrbotten . .	23·35	35·80	52·17	60·70	59·10	59·99	61·20	63·28	64·99	63·69	65·73
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

phorus-content rarely exceeding 0·03 %. As to the proportion of sulphur, 87·7 % of the prime ore produced in 1913 contained less than 0·05 % and only 3·1 % more than 0·10 %.

In 1913 were extracted altogether 10 989 005 tons of *ore* and *waste*, out of which were obtained 7 475 571 tons of picked ore and concentrate, making on an average 68·0 % of the rock hoisted. The average quantity of iron ore relatively the rock hoisted for the whole of Sweden during the last 20 years has fluctuated between 54·5 % in 1893 and 71·1 % in 1911, and since 1903 has exceeded 62 %. This may be to a great extent accounted for by the big contribution to the output of iron ore made during these years by the Norrbotten mines, in which the quantity of ore is for the most part high. In the mines of Central Sweden the quantity of iron ore fluctuates as a rule, between 50 and 60 % of the rock hoisted.

The concentration of iron ore was carried on in 1913 at 38 concentration works, in which out of 1 537 664 tons of ferriferous materials 381 190 tons of concentrates were produced. The following table summaries will serve to give some notion of the quality of the crude ore and of the concentrate produced from it.

Average Iron-content	Crude Ore tons	Concentrate tons
less than 30 percent	220 691	—
from 30 to 40 percent	911 545	—
» 40 » 50 »	386 569	—
» 50 » 60 »	18 859	2 711
» 60 » 70 »	—	609 482
70 percent and over	—	45 783
Total	**1 537 664**	**657 976**

Average Phosphorus-content	Concentrate tons
less than 0·005 percent	181 141
from 0·005 to 0·010 percent	220 687
» 0·010 » 0·020 »	81 575
» 0·020 » 0·030 »	4 807
» 0·030 » 0·050 »	87 357
» 0·050 » 0·100 »	18 371
0·100 percent and over	64 038
Total	**657 976**

Average sulphur-content	Concentrate tons
less than 0·005 percent	30 109
from 0·005 to 0·010 percent	67 457
» 0·010 » 0·020 »	68 561
» 0·020 » 0·030 »	65 082
» 0·030 » 0·050 »	8 080
» 0·050 » 0·100 »	139 844
0·100 percent and over	238 765
Sulphur-content not given	40 078
Total	**657 976**

The number of workmen employed in 1913 in Swedish iron mines and in concentration and briquetting works for iron ore was 11 811, out of which

TABLE 45. *Sweden's Export of Iron Ore.*

Year	Total iron ore extracted in Sweden	Sweden's Export of Iron Ore to						Total Export
		Germany	Great Britain	Belgium	France	America	Other countries[1]	
	tons	tons	tons	tons	tons	tons	tons	tons
1906	4 501 656	2 941 245	204 161	18 341	26 400	30	471 039	**3 661 216**
1907	4 478 917	2 838 561	446 635	112 153	26 252	11 119	86 997	**3 521 717**
1908	4 712 494	2 948 386	450 014	79 768	39 521	11 140	125 439	**3 654 268**
1909	3 885 046	2 546 321	407 855	89 062	24 898	121 139	7 178	**3 196 453**
1910	5 549 987	3 276 605	584 185	141 579	42 251	270 661	98 319	**4 413 600**
1911	6 150 718	3 706 636	575 984	159 290	41 422	262 591	340 975	**5 086 898**
1912	6 699 226	4 217 958	621 881	211 155	47 700	334 678	87 281	**5 520 653**
1913	7 475 571	4 977 394	672 836	231 647	38 683	361 215	158 020	**6 439 750**

[1] These figures include export to Norway and the Netherlands, to which countries ore is exported only in transit, chiefly to Germany.

3 625 were underground workers and 2 151 surface workers. The output per man was 633 tons of ore and concentrates. The working efficiency of underground workers was 1 283 and of surface workers 2 946 tons of ore and rock. This represents a considerable increase of efficiency per workman.

The cause of this increase is principally the vigorous development of the technique of boring machines during the last decennium.

The value of the iron ore produced in 1913 was 60 003 715 kronor, corresponding to an average value of ore of 8·03 kronor per ton.

Sweden's export of iron ore was in 1913 6 439 750 tons, corresponding to 86·1 % of the output for the whole country in the said year. The bulk of it was exported to Germany, besides which Great Britain, the United States, Belgium, France and other countries are more or less big customers for Swedish ore.

The Table 45 attempts to give the amount of the export of ore during recent years.

The export of iron ore was down to 1886 conducted only on a small scale — in the last-named year 19 288 tons were exported. In 1887, however, the export from Grängesberg commenced and the figures for export leapt up into 100 000 to 180 000 tons. In 1892 ore began to be exported also from Gällivare, which brought the export gradually up to over 1 700 000 tons (1 729 303 tons in 1901). After Kirunavara thanks to the completion of the railway to Riksgränsen, had secured in 1902 an export route to Ofotenfjord, the export rose at one blow with over a million tons (2 827 428 tons in 1903), and has since then been rapidly augmenting. The appended diagrams serve to bring this out, as well as the ratio between the export and the domestic consumption.

Other important export fields are Blötberget since 1901, Idkerberg since 1902, Lekomberg since 1902, the Carlvagns mines in Norberg since the end of the nineteenth century, and Strássa since 1909.

The total iron ore export of Sweden up to 1910 inclusive was:

Iron Ore low or moderate in phosphorus	. . . . .	1 705 000 tons
» » rich in phosphorus from Central Sweden	. . .	11 315 404 »
» » » » » » Norrbotten, circa	. . .	27 623 400 »
	Total	**40 643 804** tons

The ore export from the ore fields of Lappland as well as from the export field of Grängesberg has been, owing to the *agreements* concluded in 1907, 1908, and 1913 between the Swedish State and the companies who own these fields, (Luossavaara-Kiirunavaara aktiebolag, Aktiebolaget Gellivare malmfält and Trafikaktiebolaget Grängesberg-Oxelösund) restricted for the period from 1908 to 1932 to

for Kirunavara	. . . . .	103 100 000 tons
» Gällivare	. . . . .	30 650 000 »
» Grängesberg	. . . . .	13 250 000 »
	Total	**147 000 000** »

exclus. the ore which is obtained by concentration from the gangue (*varp*), that is, the ferriferous rock which falls away in the extraction of the ore or which has to be extracted in order to get at the ore, but which is too poor to be available in its unprepared condition for export. In connection with these agreements the State became a shareholder as to half in the Luossavaara-Kiirunavaara aktiebolag and the proprietor both of the Luossavara, the Mertainen, the Ekströmsberg and other mines and also of the Svappavara and Leveäniemi and other iron ore deposits in the län of Norrbotten, though with the proviso that there should be no export of ore from these fields prior to 1932. The State receives for this a royalty, calculated according to various considerations, on every unit quantity of ore raised, and has the right to buy in all the shares in the companies in 1932, after a valuation of them has been made.

Mines with Ores other than Iron Ore.

Sweden is comparatively poor in ores other than iron ore. At present the only ores mined are zinc, lead, copper, manganese and iron pyrites. Thus in 1913 10 013 tons of zinc ore were extracted in 4 mines, 3 924 tons of copper ore out of 6 mines, 215 tons of lead ore in 2 mines, 107 tons of manganese ore in one mine, and 34 295 tons of iron pyrites out of one mine. The aggregate value of the said output amounted to 1 008 805 kronor. Besides this, there were obtained by concentration 40 739 tons of zinc concentrates, 3 007 tons of lead concentrates, 1 534 tons copper concentrates, 3 894 tons of manganese concentrates, and 24 tons of iron pyrite concentrate, with an aggregate value of 2 495 623 kronor.

The biggest and most important deposit of zinc ore is that at Åmmeberg in Southern Sweden with a length of about 5 kilometers and with a breadth which in places reaches up to 12 meters. Other deposits of zinc are those at Kaveltorp, Saxberget, Stollberg, and Sala. In all these deposits the ore mineral consists of zinc blende, frequently commingled with lead glance and copper pyrites and it is from these mines that the above stated quantities of lead ore have been yielded.

Copper ore is mined at present only in the Falun Mine, where however, the output of copper ore plays a very subordinate role in comparison with the output

of iron pyrites. The Falun Mine also yields a little gold, which chiefly occurs in solid form along with seleno-wismuthit. Copper ore has also been extracted from the Bersbo mines at Åtvidaberg and at Nautanen in Lappland.

Manganese ore is mined at present at Spåxeryd in Småland, where it occurs in the form of lodes in the granite, and at Långban in Värmland, where the ore consists of braunite and hausmannite, forming more or less irregular stratiform bodies in the dolomite.

Nickel and cobalt ore were mined in ancient times in a few isolated deposits in different parts af the country. The chief of these are the deposit of nickel ore at Kleva in Småland and the deposit of cobalt ore at Tunaberg in Södermanland.

Gold ore has been mined, besides at Falun, at Ädelfors in Småland. A good quantity of silver was in former times produced by the Sala mines.

Coal Mines.

Coal is found in Sweden only in the southernmost part of the kingdom, the province of Skåne, in seams together with fire-clays and ordinary, non-refractory clays in layers belonging to the Rhæt-Lias system; the total thickness of the coal seams does not exceed 1·5 meters, out of which, however, only from 0·3 to 0·6 meters consist of coal the rest being bandes of shales.

The coal-seams vary in numbers in different parts of the district, but only two of them are worth mining. The beds of the coal-bearing formation are, for the most part, in a horizontal position or very slightly inclined. Dips as high as 20 degrees or more are rare. Nowhere have folds or sharp bends been observed, faults, however, are quite common. In 1913 there were 8 coal-fields in work, and from them were raised through 15 shafts 363 965 tons of coal with a value of 2 949 032 kronor, 136 944 tons of fireclay with a value of 232 835 kronor, and 50 936 tons of clinker clay with a value of 117 753 kronor. The principal coal mines are those at Höganäs, Billesholm, Bjuv, Skromberga, Ormastorp, and Hyllinge.

The supply of coal in the mining fields of Skåne is estimated at about 300 million tons; out of which about 50 % consists of coal N:o 1 with average percentage of ash up to 13 %, 40 % of coal N:o 2 with from 14 to 35 % and 10 % of coal N:o 3 with from 36 to 55 % of ash.

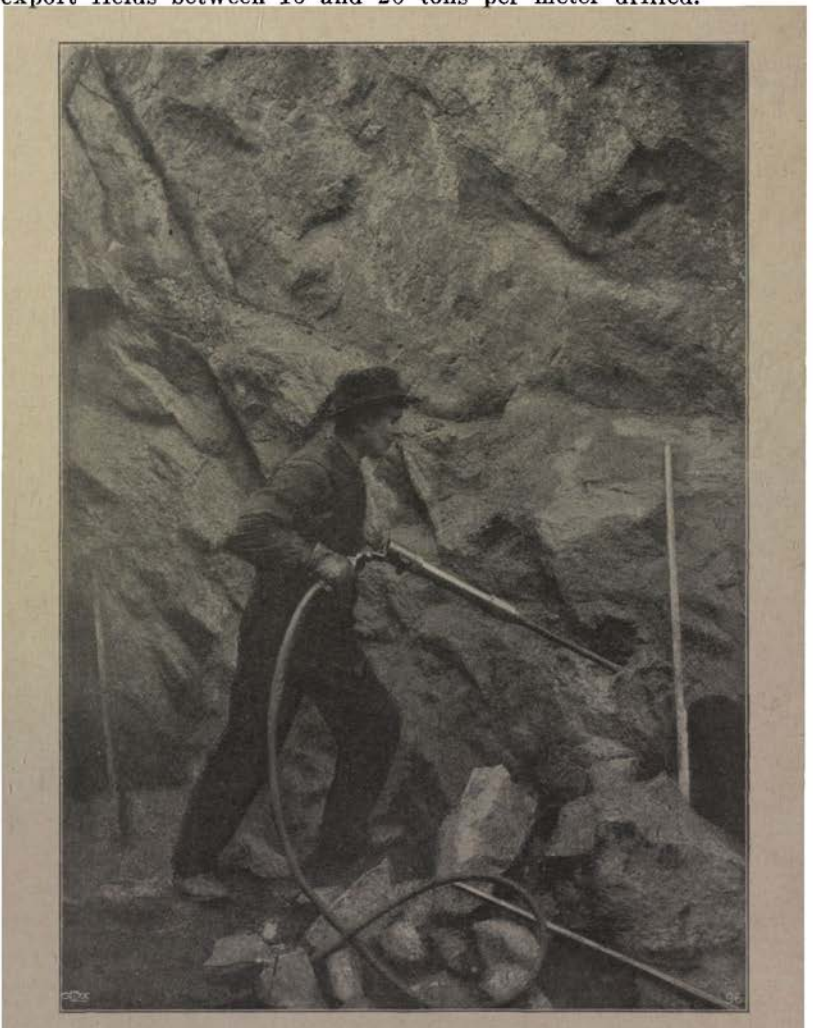
The Mining Practice in Swedish Mines.

Breaking Ground. *Boring and Blasting.* The hand-drilling was the only method of boring until the last years of the seventies; machine-drilling with compressed air begun to be introduced in the mines of Sweden, at first at Åmmeberg in 1878 and at Falun Mine in 1879. Nowadays, after that in the first decennium of this century light and efficaceous hammer-drill machines, specially adopted for Swedish mines purposes have been constructed, hand-drilling is used only in some smaller mines in Sweden.

Explosives. The explosive almost exclusively used in the Swedish ore mines is *gelatine dynamite:* in recent years, however, a new explosive

based on ammonium perchlorate, of Swedish make, named *territe* has come into use alongside of gelatine dynamite.

Concerning the general effect of blasting in the Swedish ore mines the amount of rock broken down varies on an average between 8 and 15 tons, and, where circumstances are favourable, 20 to 25 tons per kilogram of explosive, and between 2 and 3 up to 8 to 15 tons, and in the open-cuts in the export fields between 10 and 20 tons per meter drilled.



Swedish Hammer-drill Machine.

Mining Methods. The oldest method of mining employed in Swedish *ore mines* is "*pallbrytning*" (underhand stoping) this ancient method is still extentively employed. It is used principally in open-cut mines; for underground mines nowadays it is chiefly the smaller mines that stick to it; the bigger mines are going over to other methods.

The underhand stoping method was down to 1858 the only method of mining employed in Swedish ore mines; in that year *takbrytning med igensättning* (overhead stoping with filling) was introduced in the Ämmeberg zinc mines, but it was not till 1869 that the method began to be employed in a Swedish iron mine, notably at Dalkarlsberg, after which the method was gradually introduced into quite a number of mines, both in Central Sweden and in the Gällivare Malmberg in Norrbotten. About 1900 a new mining method was introduced, namely *magasineringsbrytning*; (skrinkage stoping) that is overhead stoping without filling, in which a considerable part of the ore broken is allowed to remain until the working room has been excavated. This method, which was first adapted at Grän-

Ore Bins, Dalkarlsberg.

gesberg and Striberg, has gradually obtained a very general application, and in many places has replaced the overhead stoping with filling process or the underhand stoping method. The crosscut slicing with filling *(tvärbrytning med igensättning)* has been employed since the seventies in a number of mines with loose or readily crumbling ore; in the last ten years, however, the methods employed in mines of this kind have been the subdrift of caving system *(rasbrytning)* specially the top slice system.

In the Swedish *coal mines* is as a rule used a combination of pillar and stoll working and longwall system.

The *shafts* in Swedish mines are either perpendicular, which is usually the rule, or inclined following the dip of the ore body.

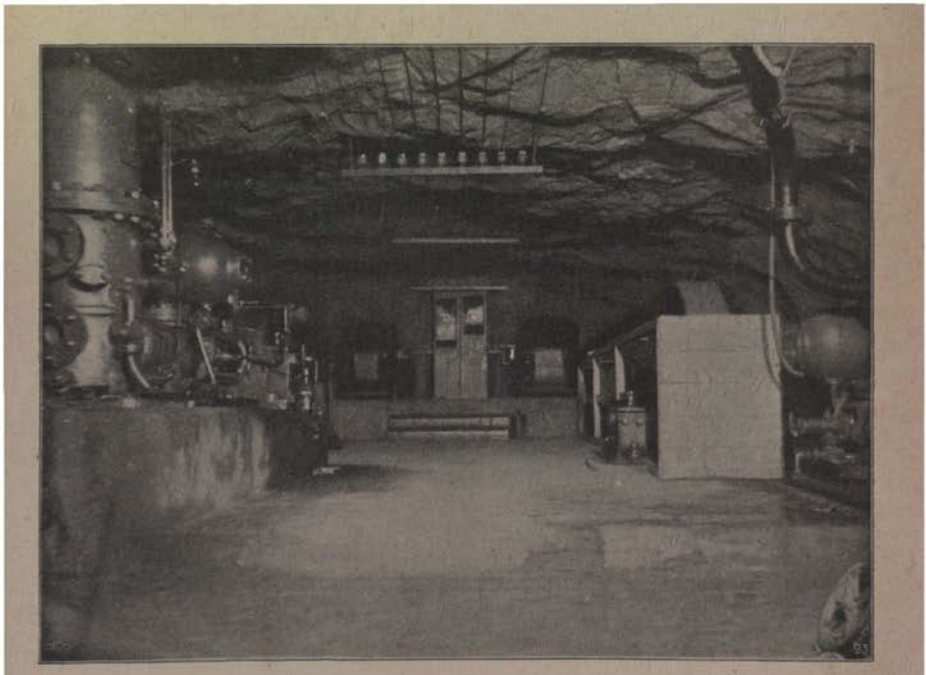
The older shafts are usually circular with a cross section area of up to about 40 square meters. The more modern shafts in ore mines are rectangular, and have an area usually of not more than from 18 to 25 square meters, occasionally of only 10 square meters; in the big export fields, on the other hand, they are considerably larger, with an area of up to 40 or 41 square meters. The shafts at the coal-mines are circular.

The shaft head-houses are usually wooden and are sometimes wholly or partially covered with planks, sometimes uncovered. More rarely occur shaft head-houses of slag bricks, or constructed entirely of iron.

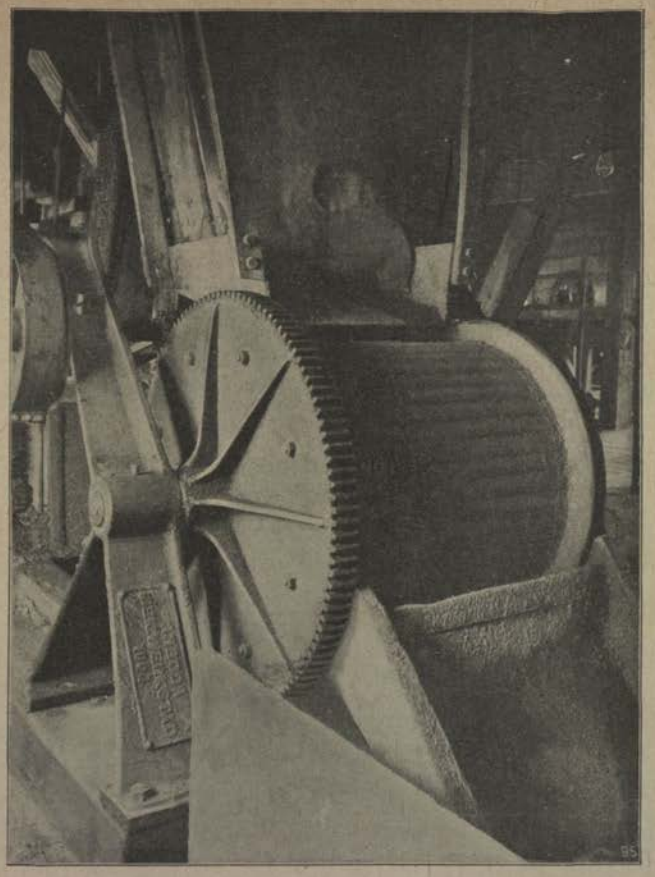
The Mine-drainage. The flow of water in Swedish ore mines is as a rule rather slight, and only in isolated cases amounts to as much as 300 to 500 liters per minute. In the smaller mines lifting pumps are used, in others force-pumps; in the last ten years electrically driven centrifugal and plunge pumps have been coming more and more into use: they are installed at the bottom of the mine. In quite recent times water pumps worked by pressure air have come into use.

The hoisting of rock and water in several smaller mines is effected with the aid of water wheels and turbines. In many mines steam engines as well as oil and gas motors are employed. During the last few decades electric motors have been coming more and more into use for these purposes, whereas the horse-gears (*hästvandringar*) which were once so common have now practically disappeared.

In 1913 were employed in Swedish ore mines for the raising of rock and water:



Pump-room, Dalkarlsberg.



Magnetic Coarse-Separator, system Wenström.

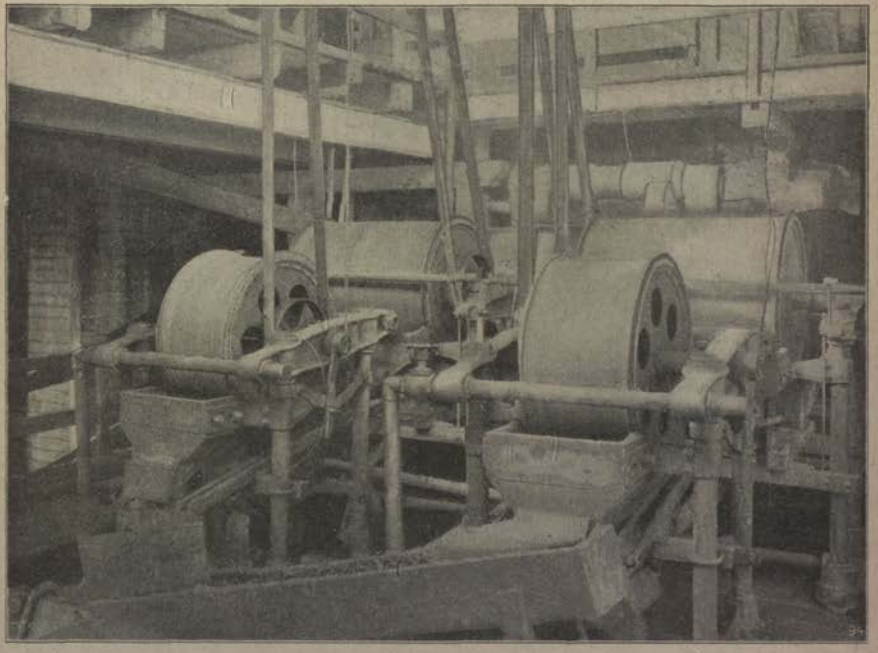
33	waterwheels	of altogether	684	horse power.
18	water turbines	" "	453	" "
80	steam engines	" "	2 852	" "
34	oil and gas motors	" "	429	" "
296	electric motors	" "	10 123	" "
Total **461**	motors	of altogether	**14 541**	horse power.

Ventilation. In by far the greater number of Swedish mines natural ventilation in most cases suffices. Where artificial ventilation is required, as in long levels or in raises, electrically driven centrifugal ventilators are generally employed, or else ventilation is provided by means of injectors with compressed air.

Lighting. The underground working rooms are lighted by open lamps in most cases gas-oil or petroleum lamps; in recent years, however, acetylene lamps are used to a considerable extent in the Swedish mines. The main levels are often lighted by electric incandescent lamps. In the rock-

houses and other buildings either electric lamps or Lux lamps are employed. At the open cut works in the export fields electric incandescent lamps are burnt during the dark hours.

Ore-Treatment. In most of the iron mines the separation of the valuable minerals from the valueless material is carried out simply by hand-sorting and hand-picking in rock-houses erected in the immediate neighbourhood of the shaft-head. The small ores *(syltan)* is afterwards subjected to washing and picking by hand.



Magnetic Ore-separator, system "Gröndal V".

Since 1884, however, the washing process in several mines with magnetic iron ore has been replaced by coarse separation with *magnetic ore separators (malmskiljare)*. Besides the *Wenström* ore separator which was the first employed, several more modern ore coarse separators have come into use in recent years, such as the *Landén-Josephson*, the *Vulcanus*, the *Gröndal*, and several others. The extent to which magnetic coarse separation is carried on in Sweden will be realized by the fact that in the course of the years from 1885 to 1913 3 892 699 tons of iron ore have been produced by means of magnetic coarse separation. In 1913 magnetic coarse separation was employed at 30 mines, and the output was 1 058 655 tons of ore.

At the end of the nineties the *concentration (anrikning)* process for poor ores and ferriferous gangue began to make its way into Sweden, and

since that time has become more and more widely used. Magnetic concentration is at present used to in some thirty concentration works. In 1913 the output of iron ore concentrates *(järnmalmslig)* was 657 976 tons with a value of 6 624 033 kronor, and since 1897 about 3 600 000 tons of iron ore concentrate have been produced.

Besides the concentration works for iron ore there are only a few concentration works for other ores, notably at the Åmmeberg and Ryllshyttan zinc mines, at the Kaveltorp, Stollberget and Saxberget zinc and lead mines, at Sala silver mine and others. For graphite there is a small concentration work at Västanfors and for manganese ore concentration works at Späxerud and Långbanshyttan.

Magnetic Ore-dressing Plant, Långnäs mine.

Mehtods of exploring for iron ore. As most of the Swedish ores contain magnetic iron ore methods of discovering ore deposits by the deflection of a magnetic needle in the vicinity of magnetic ores have long been in use. In the middle of the eighteenth century the miners compass *(gruvkompass)* was constructed; with that simple instrument numerous ore deposits have been discovered in Sweden. However, in the sixties and seventies of the nineteenth century attempts were made to devise magnetic measuring instruments by means of which a more exact and more detailed knowledge of the magnetic conditions could be attained. These endeavours resulted in

the invention of the *Thalén's Magnometer* (about 1870) for measuring magnetic horizontal intensity as well as the *Tiberg Inclination Balance* (about 1880) and the *Thomson-Thalén vertical power balance* (1899) for measuring magnetic vertical intensity. The magnetic horizontal and vertical intensity maps of mining areas at the surface and the magnetic force-lineas plans *(kraftpilkartor)* of mining areas underground which have been drawn up with the aid of measurements made with these instruments have greatly facilitated the work in Swedish iron mines. These Swedish methods have indeed been coming more and more into use abroad and particularly in America.

In addition to the magnetic investigation methods, prospecting by means of *diamond-boring* has been extensively resorted to in Swedish ore mines. On account of the ease with which it is manipulated and the moderate cost at which boring can be carried out with it, the Croelius' diamond drill, with a bore-hole diameter of 35 millimeters has been almost the sole make employed.

Mine Maps and Mine Surveying. In the Mining Act of the 16th May 1884 it is prescribed that all mines shall be mapped out by specially authorized mine surveyors, and that the maps shall be completed to date year by year. The maps are drawn up in duplicate, one of which is kept as a public document in the Office of Mine Maps belonging to the Board of Trade *(Kommerskollegium)*. Maps of ore mines shall be drawn up on a scale of 1:800 and be executed in accordance with a *normal chart (normalkarta)* determined by the Board of Mines.

In accordance with this normal map only *one* horizontal section is drawn on each sheet, and the map sheets shall contain not only the configuration and the position relatively to one another of the working rooms, but also in certain fixed colours the geological conditions of the mine. Besides the plane charts each mine map shall have attached to it at least one longitudinal projection and cross sections through the mine.

In the case of coal mines the scale 1 : 1 500 is prescribed, and the maps are to be drawn in accordance with a normal map prepared expressly for coal mines.

As early as 1628 a Royal Ordinance was promulgated in Sweden providing that all mines in Sweden should be surveyed and mapped, and in 1629 the first Swedish mine map (of the Falun Mine) was drawn up.

Mining Legislation.

Ore Mines. In persuance of the Mining Act of the 16th May 1884 as amended and supplemented by the subsequent Acts of the 20 Oct. 1899, the 5 June 1901, and the 12 August 1910, any Swedish subject has the right to acquire an *inmutning* or preliminary claim to mineral deposits which contain (a) the ores of the following minerals: gold, silver, platinum, mercury, lead, copper, iron, (with the exception of lake and bog ores), manganese, chrome, cobalt, nickel, zinc, pewter, titanium, molybdenum, tungsten, vismuth, arsenic, and antimony; (b) iron pyrites, magnetic pyrites, and graphite; and (c) on Crown lands which have not been disposed of apatite and magnesite — provided that these mineral

deposits are situated at least 200 meters from dwellings, building sites, and gardens.

The claimer (*inmutare*) has the right to carry on preliminary work (*försöksarbeten*) within the area claimed, which comprises a circumference with a radius of 100 meters. The proprietor of the ground is entitled to participate with the claimer as to half in the work and in the profit that may accrue. When a deposit to which a preliminary claim has been acquired has been exposed and a sample of the ore obtained, an area called *utmål* not exceeding 200 meters in length and breadth shall be assigned to the claimer. Within this area the owner of the mine has the sole right of carrying on mining work both at the surface and underground. The downward limits of the *utmål* shall be reckoned perpendicularly.

Within each *inmutning* or *utmål* a certain amount of mining work or mine construction work shall be carried out yearly. If the claimer neglect to execute this work, the mining works will be declared forfeited (*sönad*) and the rights founded on the claim certificate (*mutsedel*) forfeited.

In the län of Norrbotten certain areas at and in the vicinity of the big iron ore fields are separated of as "State Mining Fields", and within these areas claims cannot be acquired.

Coal Mines. Stone coal deposits are not eligible for *inmutning*. The right to investigate and work such deposits under the Act of the 28th May 1886 is dependent on a special concession (*koncession*) granted by Government. The concession may not comprise a larger area than one thousand six hundred hectares. The holder of the concession is under obligation to pay a certain fee yearly to the proprietor of the ground, and it is moreover incumbent on him to perform annually a certain amount of mining work, as prescribed in the concession.

2. IRON AND STEEL INDUSTRY.

Since time immemorial the manufacture of iron has been one of the most important branches of industry in Sweden and Swedish iron is famed for its superior qualities.

This superiority is to be ascribed mainly to two causes: an abundance of good pure ores, and the use of charcoal in the production of pig iron.

As long as charcoal was used exclusively also in other parts of the world in the production of pig iron, Sweden's share in that production was very considerable, even *quantitively*.

However, as long ago as 1730 coke began to be used in English blast furnaces, and in 1785 a new fining process called "puddling" was invented in England, and in that process coal could be used.

Owing to these changed circumstances, Sweden, who possesses but little fossil coal, was compelled to assume, considering the quantity, a more and more modest position among iron-producing countries, whereas in respect to *quality* she still leads. And it may be presumed that she will contrive to maintain this lead far into the dim future.

In the middle of the eighteenth century Sweden seems to have made

TABLE 46. *Sweden's Output of Iron Ore and Pig Iron.*

Annually	Swedens Production tons	
	Iron Ore	Pig Iron
1866—70	553 759	267 854
1871—75	795 263	332 456
1876—80	726 712	357 224
1881—85	877 408	429 377
1886—90	932 470	446 580
1891—95	1 519 325	471 147
1896—00	2 294 760	517 796
1901—05	3 564 046	528 255
1906—10	4 626 913	567 503
1911	6 153 778	634 392
1912	6 700 565	699 816
1913	7 475 571	730 257

more pig iron than any other country, and at the beginning of the nineteenth century Sweden appears still to have produced nearly ten per cent of all the pig iron then made. Since then Sweden's position in this respect has shifted very much relatively to other countries, as will be shown in the sequel.

From Table 46 we shall find that the ratio between the yield of ore and the output of pig iron for the period from 1866 to 1870 was 2·07, as against 10·24 for the year 1913, which is in some measure an index of the increasing export of iron ore.

Alarmists have been raising an outcry against the *export of iron ore* from Sweden, now very considerable, scenting therein jeopardy to the iron manufacture of the future, which, they aver, will suffer, sooner or later from dearth of ore. If the ore exported actually were ore of the best quality, if Sweden possessed any appreciable supplies of fossil fuel (coal), if Sweden were a populous nation with a big iron consumption of her own, one might appreciate, one might even endorse such a view. But as matters now stand, it is perfectly reasonable, that Sweden should utilize her practically exhaustless stores of impure ore, useless for the high-quality iron she manufactures, utilize that ore by selling it to foreign countries. The dead capital represented by the unextracted ore is thus turned into a living capital, and capital is certainly wanted for that mode of iron manufacture which is most natural to Sweden, a mode of manufacture indicated by the words *quality* and *finish*, just as it is wanted, obviously, also for the industries of Sweden in general. A high-quality iron manufacture of this kind is now eked out nicely by an ordinary iron manufacture, to supersede imported iron, and in this ordinary iron manufacture both coke and phosphoriferous ores have been made use of.

During the first half of the nineteenth century, broadly speaking, only pig iron and wrought iron refined from it were produced in Sweden.

The bulk of this wrought iron was exported in the form of bars, in order to be refined abroad into steel and manufactured into finer articles. But in the latter half of that century the iron industry in Sweden, as in other countries, went forward with enormous strides. A number of improvements were introduced in the manufacture of pig iron, as also in the making of wrought iron. Moreover entirely new fining methods, such as the Bessemer and the Martin processes, came into use, and gave a vigorous push forward to the development of the iron industry.

It is true that the soft basic ingot metal used abroad has proved a rather awkward competitor to Swedish wrought iron. On the other hand, the production and manufacture of the excellent Swedish ingot metal (steel) has gone ahead with gigantic strides. This is sufficiently attested by the exhibitions in Sweden and abroad in which Swedish iron works have participated, works such as Avesta, Bofors, Degerfors, Domnarfvet, Fagersta, Finspång, Forsbacka, Hagfors, Hofors, Iggesund, Kolsva, Munkfors, Sandviken, Storfors, Söderfors, Vikmanshyttan, Österby, and so forth.

However, the Swedish iron industry has gone forward still more rapidly during recent years. Thus, in 1913 the output of pig iron was 232 000 tons, that is 46 %, greater than in 1899. Furthermore, the ingress of the twentieth century has been remarkable for a number of fresh suggestions, the *concentration and briquetting of iron ore, iron ore smelting by electricity, the making of spongy iron, steel smelting by electricity, the manufacture of alloys.* It is also marked by the use of coke as sole fuel in certain blast furnaces, by enlargements of the ironworks and modern improvements, particularly as to arrangements for the further treatment of the iron.

In the sequel a more detailed account of the progress made will be given in connection with the various processes of manufacture.

Before we pass over to this account, we must, however, first set forth a few figures relating to the *import and export of iron,* and then touch upon a question which, as indicated above, has been of vital consequence for the Swedish iron industry, the question of *fuel.*

Export. According to commercial statistics, the value of iron and steel exported, in an unwrought or only partially wrought state, was as follows:

TABLE 47. *Export of Iron and Steel (unwrought or half-wrought).*

Annually	Million kronor	Annually	Million kronor	Annually	Million kronor
1871—75	43·20	1891—95	29·97	1911	54·78
1876—80	32·35	1896—00	39·08	1912	40·35
1881—85	38·89	1901—05	38·54	1913	41·20
1886—90	33·88	1906—10	47·71		

The diagrams will bring out the fluctuations still more easy to survey.

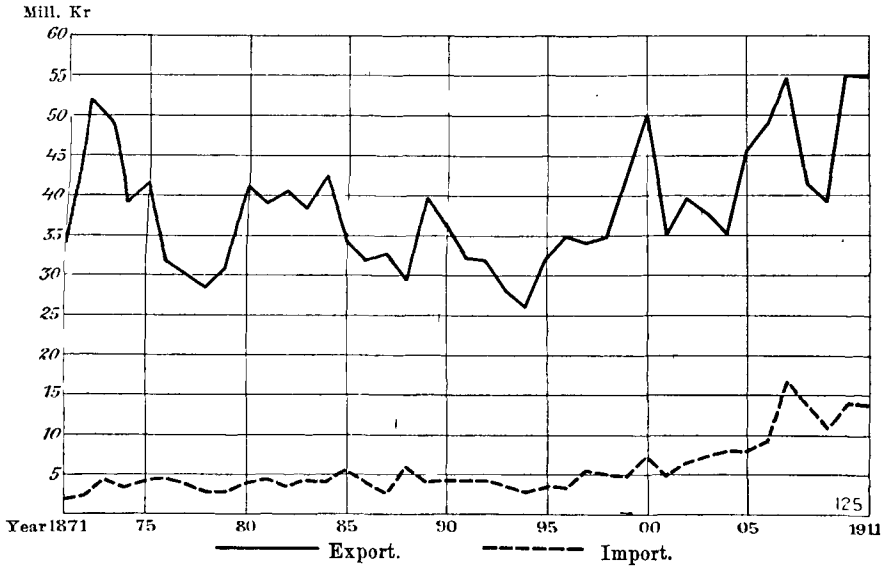
Import. The import of unwrought or only partially wrought iron and steel was during the same periods as follows:

TABLE 48. *Import of Iron and Steel (unwrought or half-wrought).*

Annually	Million kronor	Annually	Million kronor	Annually	Million kronor
1871—75	3·15	1891—95	3·50	1911	13·52
1876—80	3·47	1896—00	5·05	1912	15·07
1881—85	4·29	1901—05	6·78	1913	18·22
1886—90	4·04	1906—10	12·71		

Thus the import of iron and steel (see the diagrams further down) exhibits an advance.

Import and Export of Iron and Steel (unwrought or half-wrought).



Fuels.

In the Swedish iron industry the following fuels are employed: wood (splitwood, twigs, stumps, saw-dust), charcoal, coal, coke, and peat.

Wood. Wood in various forms is used mainly as fuel in gas producers for reheating furnaces, Siemens-Martin furnaces and other furnaces, often mixed with coal and peat.

Charcoal. The making of pig-iron in Sweden, as has been mentioned, is based on the use of charcoal in the blast furnaces, and this is one of the

TABLE 49. *Consumption of Charcoal in Swedish Iron Works.*

Year	Consumption in 1 000 cub.m	Consumption in tons	Year	Consumption in 1 000 cub.m	Consumption in tons
1899	4 418·2	662 730	1907	4 694·5	704 175
1900	4 685·6	702 840	1908	4 144·7	621 705
1901	4 531·4	679 710	1909	3 141·6	471 240
1902	4 528·5	679 275	1910	4 083·2	612 480
1903	4 329·1	649 365	1911	4 054·1	608 115
1904	4 406·4	660 960	1912	4 322·0	648 306
1905	4 346·9	652 035	1913	4 265·9	639 885
1906	4 640·7	696 105			

reasons of the superior quality of the pig-iron. Charcoal is moreover used in the various processes for refining in hearths.

The Table 49 shows the *consumption of charcoal* in Swedish iron works during a series of years.

The consumption as a whole has decreased pretty considerably. Various circumstances are answerable for this, first and foremost the rise in the price of charcoal in recent years. This rise is in its turn due to higher wages, and, above all, to the enormous demand on the part of the flourishing wood pulp industry for woods formerly appropriated exclusively to charring.

The Table 50 shows the *consumption of cellulose wood* in 1 000 cubic meters (dry measure) during each of the years from 1899 to 1913.

TABLE 50. *Consumption of Cellulose Wood.*

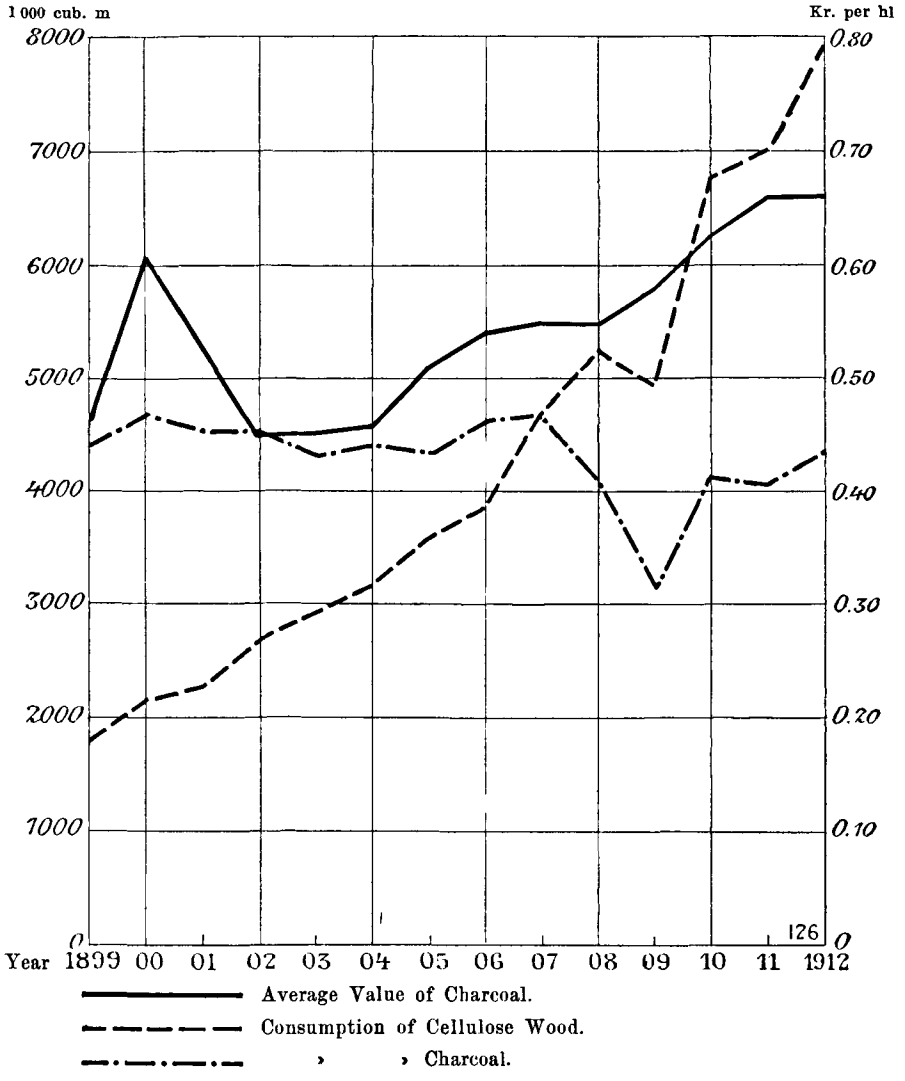
Year	in 1 000 cub.m	Year	in 1 000 cub.m
1899	1 793·9	1907	4 693·3
1900	2 119·4	1908	5 294·6
1901	2 273·1	1909	4 961·0
1902	2 667·5	1910	6 719·2
1903	2 954·9	1911	7 014·4
1904	3 158·7	1912	7 954·4
1905	3 586·5	1913	8 453·2
1906	3 855·2		

Tables 49 to 51 are here subjoined diagrammatically presented, in order to facilitate comparison.

TABLE 51. *Average Value of the Charcoal consumed in Swedish Iron Works.*

Year	Kr. per hl	Year	Kr. per hl	Year	Kr. per hl
1899	0·46	1904	0·46	1909	0·58
1900	0·61	1905	0·51	1910	0·63
1901	0·53	1906	0·54	1911	0·66
1902	0·45	1907	0·55	1912	0·66
1903	0·45	1908	0·55	1913	0·66

Consumption of Charcoal and Cellulose Wood. Average Value of Charcoal.



The rising prices of charcoal have compelled iron makers to use all endeavours to restrict the consumption thereof, both absolutely and per ton of pig iron and wrought iron produced; these endeavours have met with no small success.

Preparation of Charcoal. Charcoal is made chiefly in charringheaps *(milor)* in the forests. But a good deal of it is produced in charring kilns, situated either at the iron works or in other places, favourably located for the up transport of wood and the down transport of charcoal. Moreover, in the north of Sweden at the seaside there are large numbers

of saw-mills, which make charcoal out of wood waste; in these saw-mills the charcoal usually made in heaps, sometimes in kilns. These "saw-mill charcoals" are conveyed by boat and rail down to the mining districts. Many of the saw-mills in the south of Sweden also, for instance in Småland char the waste from the saws in heaps.

The reason why so much of the charring is done in heaps in the forests is that in winter-time the charcoal can easily be conveyed from the forests on sledges, without necessitating the laying down of expensive roads.

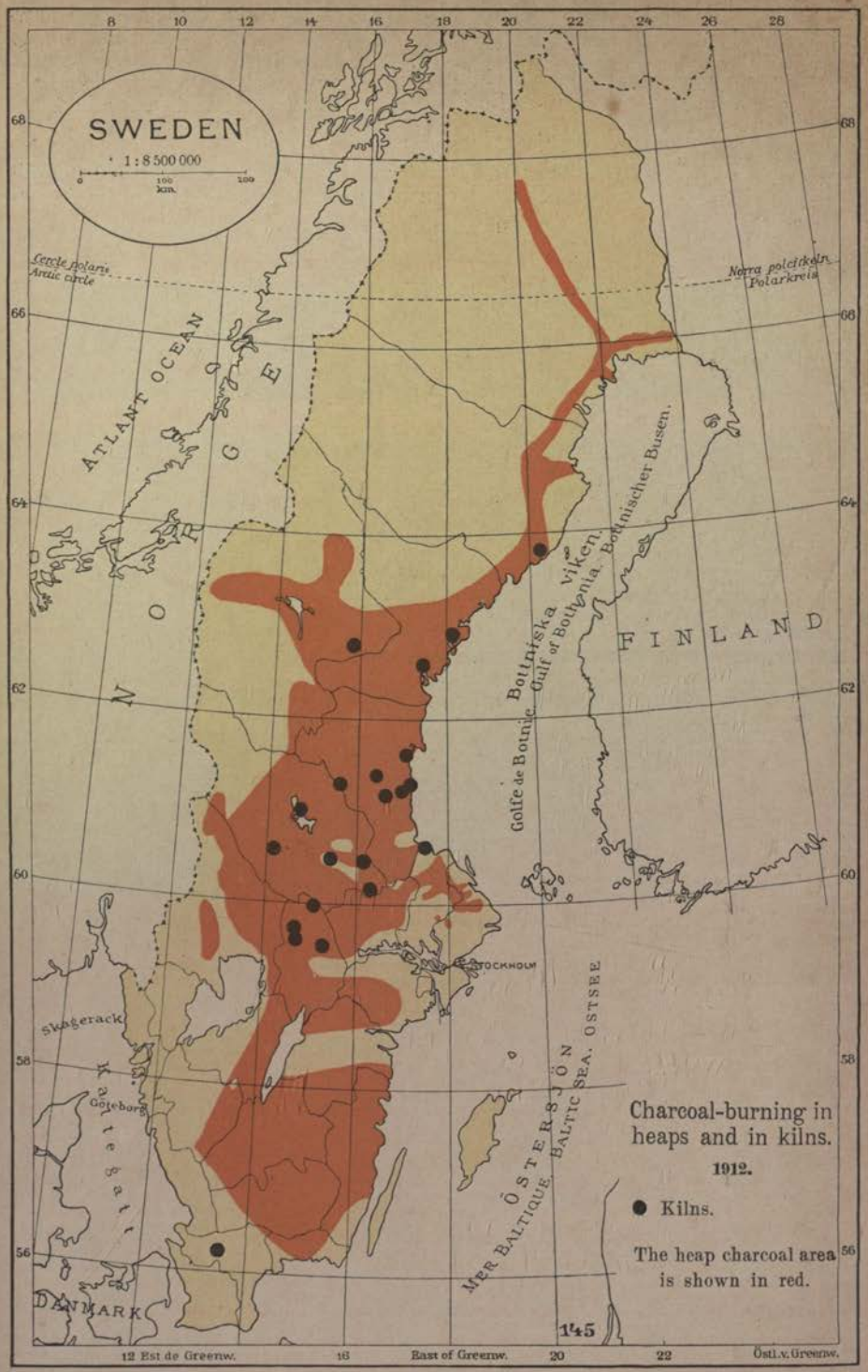
Vertical Charcoal Heap, burning.

Charcoal Heaps. There are two kinds of charcoal heaps, *resmilor*, or vertical heaps, in which the billets of wood are piled vertically, and *liggmilor*, or horizontal heaps, in which the billets are laid horizontally.

An ordinary *resmila* has a diameter of from 9 to 10 meters, and takes about three weeks to char. 20 hectoliters (= 1 läst) of charcoal is yielded by about 20 hectoliters of wood, solid measure, or about 40 hectoliters of wood, dry measure.

In *liggmilor*, the bottom of the heap is rectangular. The billets, 6 to 7 meters in length, are stacked horizontally and transversely.

Charcoal-burning in Kilns. Out of the charcoal consumed at the iron works in 1913 3 815 376 hectoliters, or about 8.9 % of the total consumption, were prepared in kilns. Charcoal-burning in kilns is thus now quite a considerable industry; the importance of this process lies particularly in the by-products obtained in it, the value of which aggregates over a million kronor per year (= circa 1/3 krona per hectoliter of charcoal). In fact charcoal kilns were originally built mainly with the intent of recovering some of the gases escaping in



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Gen. Stab. Lit. Anst. Stockholm

the combustion and obtaining from them a number of valuable products (tar, oil of terpentine, wood spirit, and acetic acid). Presumably they will come into more extensive use in the future. Another reason why the kilns are resorted to is the difficulty of obtaining a sufficient number of skilled charcoal-burners for the heaps.

In 1912 there were charcoal kilns running at 21 different places in Sweden. The map overleaf shows the position of these places. Besides these larger charcoal works, there are some smaller ones, for the charring of pine stumps (generally known as *töre*, or dry wood), in which tar and terpentine are the chief products.

Charcoal Kilns at Vansbro.

The kilns yield a larger output, by volume, than the heaps; but the charcoal obtained in the kilns is of inferior quality: it is not so well charred as the heap-charcoal. A particularly inferior quality is obtained from kilns, in which the process is short and the temperature low. On an average, 10 hectoliters of kiln-charcoal may be said to have about the same fuel-value as 9 hectoliters of heap-charcoal.

There are several types of kilns in use, but all of them fall under one of the two main groups: 1) kilns in which the heat is supplied *directly*, and 2) kilns in which the heat is supplied *indirectly*. In the first group the hearth is placed in, or communicates directly with the chamber in which the charring takes place, in the second group the wood does not come into direct contact with the flame from the hearth.

The *consumption of fuel* varies greatly according to the type of kiln, and according to the degree of moisture in the wood. It may be said, generally speaking, that for kilns in which the heat is supplied *indirectly*, and in which

air-dried wood is employed, the consumption of fuel is up to 20 % of the wood to be charred, besides which all the gas generated in the charring is consumed. In kilns where the heat is supplied *directly*, the consumption of fuel is somewhat larger.

Coal. The Swedish coals will not do for coking, and they have not been used in the actual iron-industry. On the other hand, since the end of the year 1909 they are used in the production of "spongy iron" (järnsvamp) at Höganäs in accordance with the *Sicurin* process. Coal with 35 % of ash is there used for the reduction of the iron ore concentrate, and coal with 50 % of ash for the generation of gas to heat the reducing furnace. In 1912 altogether 74 050 hectoliters of these ashy coals were employed for the manufacture of "spongy iron" and in 1913 114 760 hectoliters.

Coke. With the exception of gas-works coke and occasionally of small quantities made in some cement factories for their own requirements, coke is not made at all in Sweden. The coke works at Islinge near Stockholm, in which furnaces on the Coppée system formerly were employed, were closed down some years ago.

Peat. An account of the peat industry in Sweden will be given in the sequel in the section: Manufacturing Industries. In the manufacture of iron, peat is used almost exclusively as producer fuel. *Peat coal* is not employed at all in the iron industry. *Pulverised peat* (torvpulver) has been used experimentally during the last few years in reduction of iron ore concentrate; these experiments, however, have not yet led to any definite results.

Briquetting and Roasting of Pulverised Iron Ores.

Intimately connected with the problem of the concentration of iron ores (treated in the section: Mining) is the problem of the further treatment of the iron ore concentrate obtained in that process. Some part of the slick can be used, and is actually used, in the state in which it proceeds from the concentrating works; a smaller portion is roasted and sintered in flame furnaces; the major portion is pressed into briquettes, which are afterwards roasted and burnt in furnaces constructed expressly for that purpose.

TABLE 52. *Output of Briquettes in Sweden.*

Year	From slick tons	From purple ore tons	Total tons	Year	From slick tons	From purple ore tons	Total tons
1903	4 205	—	**4 205**	1909	141 936	34 620	**176 556**
1904	14 011	—	**14 011**	1910	252 719	62 751	**315 470**
1905	29 600	15 875	**45 475**	1911	248 809	45 277	**294 086**
1906	60 925	21 171	**82 096**	1912	279 131	58 168	**337 299**
1907	138 434	49 168	**187 602**	1913	333 252	64 345	**397 597**
1908	202 516	31 320	**233 836**				

The output of briquettes in Sweden is shown by the Table 52.

In 1913 there were 19 briquette works in Sweden; one of these works. that at Hälsingborg, manufactures briquettes out of purple ore.

For the roasting and sintering of slick is employed firstly a *flame furnace* with two storeys, constructed by *J. G. Wiborgh:* furnaces of this type are found at Baggå, Jädraås, Ljusne, Norn, Riddarhyttan. Söderfors, Ulvshyttan, Uttersberg and Åg; secondly, the *G. O. Petersson roasting flame furnace* with four storeys: at Köping and Långbanshyttan. Both of these furnaces are heated with blast-furnace gas. Provided they are properly managed, they effect a pretty satisfactory desulphurisation and oxidisation of the slick.

Experiments made in Sweden with *rotary slick furnaces* have not yielded very encouraging results.

On the other hand, the *Gröndal briquette furnace* has proved of great importance for Swedish iron industry, as is indicated by the rapid development of the briquette industry revealed by Table 52 above.

The Gröndal furnace consists of a brickwork-tunnel from 50 to 60 meters in length, and from 1·12 to 1·50 meters in breadth. Sometimes two of these tunnels are built into one, which produces what is known as a "double furnace".

The slick proceeding from the concentrating works and containing from 6 to 8 % of water, is fed down into a briquette press, in which it is pressed without any special binding medium into briquettes of 150 by 150 by 65 millimeters in size. These briquettes are then placed in two layers on cars, each of which takes from 170 to 200 briquettes. At intervals of certain minutes one car after the other is pushed into the one end of the briquette furnace; this shoves forward all the cars in the furnace one car-length, and thus one car with finished briquettes comes out at the other end. The above-mentioned interval varies according to the quality of the slick: with sulphuriferous slicks it is about an hour; at Sandviken, for instance, the time is from 40 to 45 minutes. A car of briquettes weighs there on an average 830 kilograms, and the output per week of 7 working days is from 190 to 210 tons.

The actual hearth of the furnace is formed by the refractory brickwork upper frame of the cars. The furnace is heated with producer gas (occasionally with blast-furnace gas), and the consumption of coal is from 6 to 8 % of the weight of the briquettes. The producer gas is admitted at about the centre of the furnace. The combustion gases are carried in the opposite direction to the cars, and the air used in the combustion of the gas is led in the same way through the rear part of the furnace, where it cools the briquettes already burnt, and is itself heated before it reaches the inlet for the gas.

Provided it be properly managed, the Gröndal furnace desulphurises the briquettes very completely and oxidizes them in an extremely high degree. Thus, it may be mentioned that sulphur percentages of 0·17 and 1·33 % have been reduced by it to 0·006 and 0·030 % respectively, and that the degree of oxidation in the former case was raised from 89 to 99·5 %.

The pores take up from 20 to 30 % of the whole volume of the briquettes.

The great importance of briquettes for the Swedish iron industry lies in the saving of charcoal effected by their use in blast furnaces. It may be roughly estimated that on an average a saving of 12·5 % of charcoal has been effected in the works employing briquettes.

The Manufacture of Pig Iron.

Pig-iron was first manufactured in Sweden not later than the fifteenth century: the date cannot be determined more precisely. The manufacture of pig-iron gradually developed out of the process called *bläster-smide* or the *blast forging*, the product of which was wrought iron.

Statistics of pig-iron manufacture are also unsatisfactory for the earlier periods: they can scarcely be said to be reliable before they get down to the nineteenth century.

Table 53 gives the figures for the *production, import and export, etc., of pig-iron* during the last 50 years.

The world's output of pig iron since 1871 is represented in Table 54. This table shows, that the output of pig iron in Sweden has relatively declined. The causes of this decline have been pointed out above.

If, on the other hand, one examines the Swedish pig iron industry separately, it will be found that the output has been more than trebled in the last fifty years, that the export during the said period has been more than thirteen times greater, and that the consumption per head of population has been more than doubled. Further, it will be seen that the number of blast furnaces on an average for the years from 1861 to 1865 was 222, with 30 678 working days as against 117 blastfurnaces and 35 265 working days in 1913, and that during the said period the output per blast furnace and year was 923 tons, and per working day 6·68 tons, as against 6 241 and 20·73 tons respectively in 1913. The output per blast furnace and year has thus been nearly septupled since the period from 1861 to

TABLE 53. *Production, Import and Export, etc., of Pig Iron in Sweden.*

Annually	Mean Population	Production	Import	Export	Surplus of export	Consumption	
		tons	tons	tons	tons	tons	kg per head of pop.
1861—65	3 993 000	204 826	5 533	14 212	8 679	196 147	49
1866—70	4 166 000	267 854	4 530	24 280	19 750	248 104	60
1871—75	4 274 000	332 456	13 436	54 320	40 884	291 572	68
1876—80	4 500 000	357 224	15 900	35 973	20 073	337 151	75
1881—85	4 605 000	429 377	20 050	53 093	33 043	396 334	86
1886—90	4 742 000	446 580	25 515	59 205	33 690	412 890	87
1891—95	4 832 000	471 147	28 027	66 766	38 739	432 408	89
1896—00	5 032 000	517 796	47 233	82 781	35 548	482 248	96
1901—05	5 214 000	528 255	46 174	85 470	39 296	488 959	94
1906—10	5 406 000	[1] 567 418	70 858	117 891	47 033	520 385	96
1911	5 542 000	[1] 634 392	77 049	150 444	73 395	560 997	101
1912	5 583 000	[1] 699 816	84 473	192 788	108 315	591 501	106
1913	5 621 000	[1] 730 257	94 675	195 230	100 555	629 702	112

[1] In *electric* blast-furnaces in 1908, 1909, 1910, 1911, 1912 and 1913 122, 302, 890, 5 786, 17 561 and 31 916 tons respectively.

TABLE 54. *The World's Production of Pig Iron.* In thousands of tons.

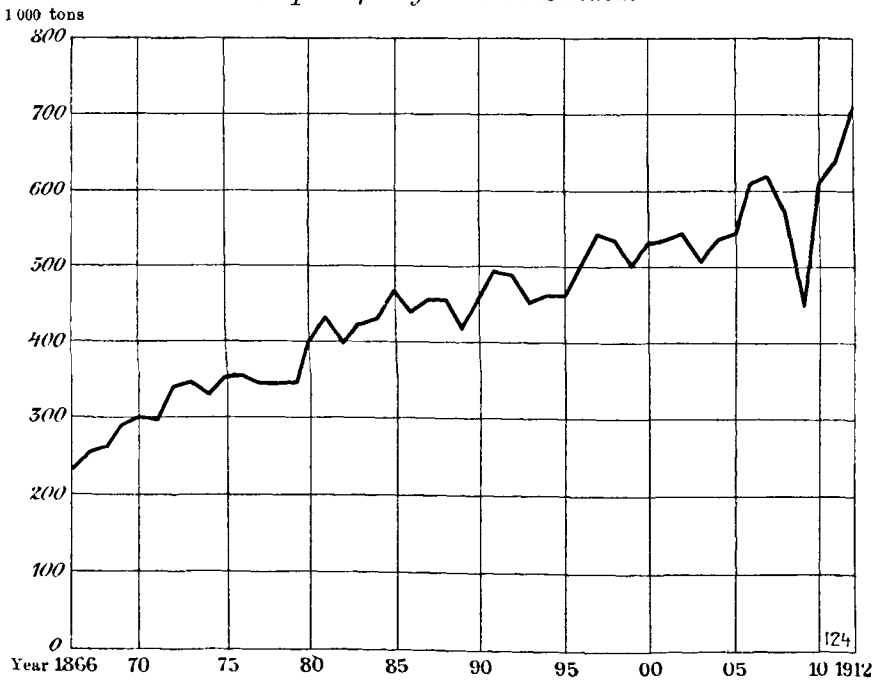
Country	Annually										
	1871—75	1876—80	1881—85	1886—90	1891—95	1896—00	1901—05	1906—10	1911	1912	1913
Sweden	332	357	429	447	471	518	528	568	634	700	730
Great Britain .	6 562	6 765	8 227	7 883	7 361	9 002	8 880	9 944	9 875	8 891	10 647
Belgium. . . .	589	495	720	781	766	1 006	1 129	1 510	2 045	2 345	2 477
Germany . . .	1 946	2 176	3 411	4 215	5 082	7 446	9 472	13 010	15 567	17 869	19 309
Austria	316	186	475	573	686	932	1 020	1 416	1 528	1 760	.
Hungary .	153	232	185	234	323	444	422	512	600	553	.
France	1 265	1 518	1 899	1 693	2 006	2 525	2 742	3 592	4 507	4 948	5 122
Russia	389	428	493	695	1 185	2 315	2 600	2 760	3 579	4 185	.
U. S. A. . . .	2 284	2 604	4 370	7 193	8 263	11 677	18 531	24 410	24 028	30 204	31 462
Other Countries	335	356	477	569	608	764	1 287	1 578	1 867	2 040	.
Total	**14 171**	**15 117**	**20 686**	**24 283**	**26 751**	**36 629**	**46 611**	**59 300**	**64 230**	**73 495**	.

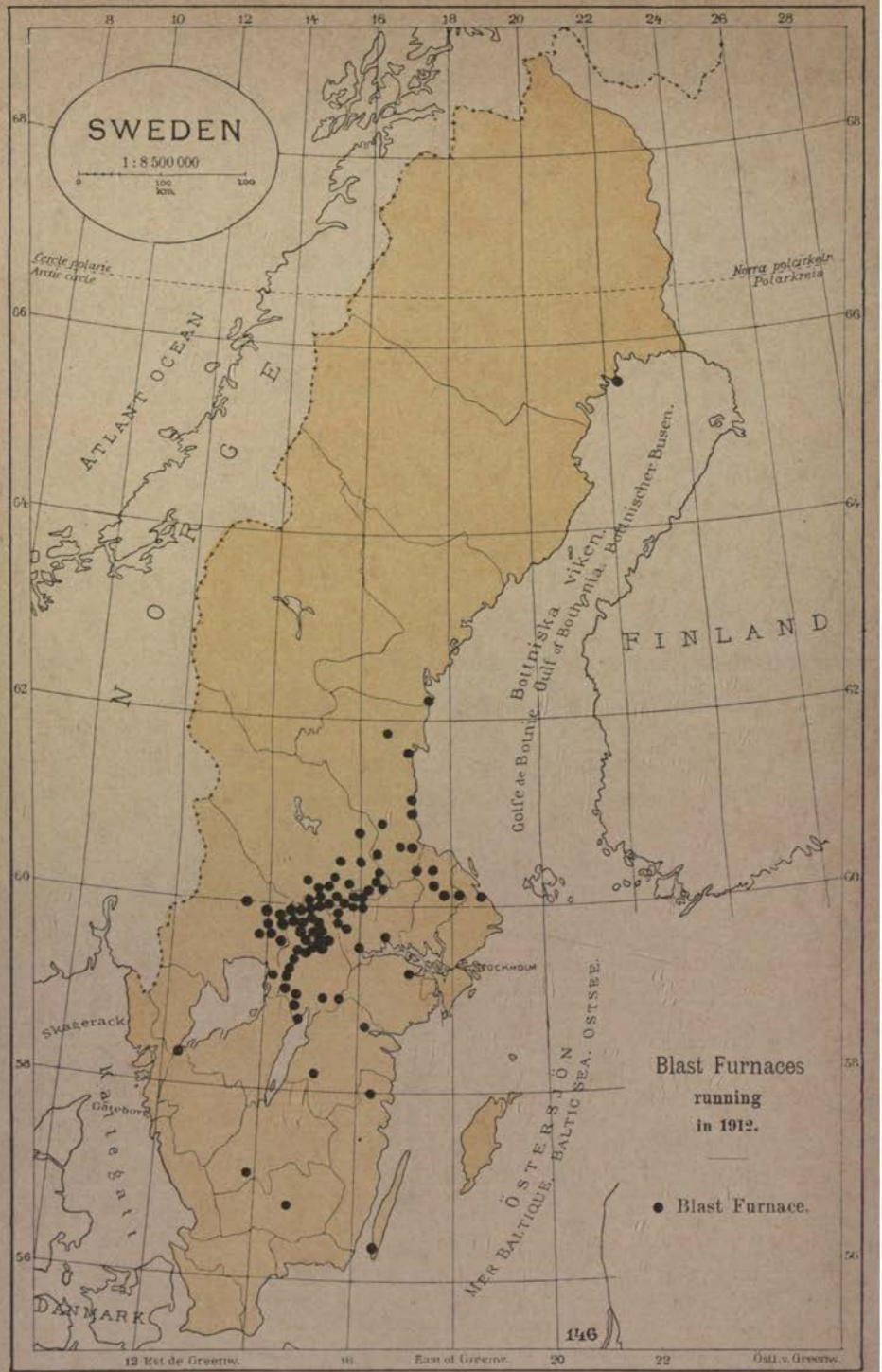
1865, and the output per working day has during the same time been trebled. One observes distinctly the greater concentration, the larger scale of operation.

The Domnarfvet Iron Works show the biggest output per average day that was attained during the year 1913, namely 52·05 tons.

The use of coke solely or of coke mixed with charcoal in the making of pig iron has increased during the last few years. The iron thus produced is intended, for home consumption, to supersede imported iron of

Output of Pig Iron in Sweden.

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Gulf of Bothnia
Bottnischer Busen
Golfe de Bothnie
STOCKHOLM
Skagerack
Kattegatt
Göteborg
ÖSTERSJÖN
MER BALTIQUE
BALTIC SEA
OSTSEE
DANMARK
Blast Furnaces
running
in 1912.
Blast Furnace.
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coke quality, or to supersede wrought iron (Lancashire iron); in the latter case it is applied to not very exacting purposes.

A blast-furnace plant for coke is now being constructed at Oxelösund.

The location of the blast furnaces at work in 1912 is shown by the map overleaf.

Out of the total production of pig iron in Sweden in 1913

23·53 %	fell to Örebro län,	26·22 %	fell to Kopparberg län
14·88 »	» Gävleborg »	9·94 »	» Västmanland »
8·53 »	» Värmland »	4·68 »	» Uppsala »
3·27 »	» Norrbotten »	2·68 »	» Östergötland »
2·52 »	» Stockholm »	and the remaining 3·75 % to Södermanland, Jönköping, Kalmar, Älvsborg and Västernorrland län.	

The pig iron produced in 1913 was proportioned as follows:

Pig-iron for refining in hearths	25·98 %	(year 1892 . . . 66·13 %)
Bessemer pig-iron	19·77 »	(» » . . . 30·53 »)
Martin »	50·03 »	
Spiegeleisen	0·01 »	(» » . . . 0·19 »)
Pig-iron for malleable castings	1·99 »	(» » . . . 1·10 »)
» » other purposes	2·22 »	(» » . . . 2·05 »)

About 75 % of the total output was consumed in Sweden itself, by far the greater part of it for the production of wrought iron and steel.

The imported pig iron was used mainly by the foundries.

Out of the pig iron exported in 1913 104 958 tons (54 %) went to Great Britain, 37 732 tons (19 %) to Germany, 14 596 tons (7·5 %) to France.

Out of the pig iron imported in the same year 84 589 tons (89 %) came from Great Britain, and 8 612 tons (9 %) from Germany.

Preparation of Pig Iron. The manufacture of pig iron in Sweden has undergone very great changes in the course of the years.

In olden times wrought iron in Sweden, as in other countries, was always made direct from the ore. The first method, used for this work, of which anything definite is known was the blast forging process (blästersmide). The blast forge or kiln *(blästerugn)* was about 2 meters in height.

In the fifteenth century the furnaces were made higher, and wood charcoal was used in lieu of wood. The heat of the furnace was now intenser, and the reduction of the ore more complete; a more carburetted and easily smelted iron was obtained. The iron produced was *tackjärn*, pig-iron, and the furnaces which yielded this iron were designated *masugnar*, blast-furnaces. Out of the pig iron malleable iron was than made by remelting.

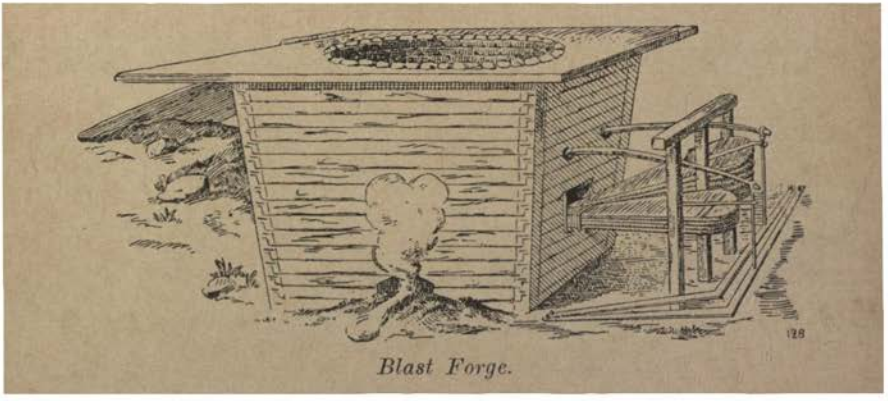
This system, of *first* producing pig iron out of the ore and *then* from that pig iron producing malleable iron or steel, by an oxidizing smelting process in hearths or furnaces, was during the following centuries and right down to the present time, practically the only system in use.

Blast furnaces. The *masugnar* or blast furnaces which were used in Sweden in the 15th and 16th centuries in passing over from *blästersmide*, the blast forge process, to the manufacture of pig-iron were rather different in construction from the *blästerugnar* or blast forges. The lower part of the furnace was built of stone; in the upper part the outer walls were made of timber, and

on the inner side, next to the shaft wall, was filled with earth and sand. The height of the furnace was only from 6 to 7 meters.

From a technical point of view, the manufacture of pig-iron went forward very slowly. The height of the shaft was slightly raised, and the timber walls were replaced by walls of stone; but the form of the shaft, the material of which it was constructed, the blowing-machines, and so forth, remained much the same as before down to the thirties of the nineteenth century. Then, however, several important improvements were introduced. Hot blast came into use, the shaft was made of fire bricks instead of stone, and its lower part, the *ställe*, was given a round shape and was made of stamped quartz, mixed with some fireclay, this mixture being rammed in round wooden frames. These *ställen* with their covering of stamped quartz stood a great deal of wear and tear, and thus allowed of longer blasts.

However, the most important improvement then introduced was with regard to the *calcining* or *roasting of the ores.*



Blast Forge.

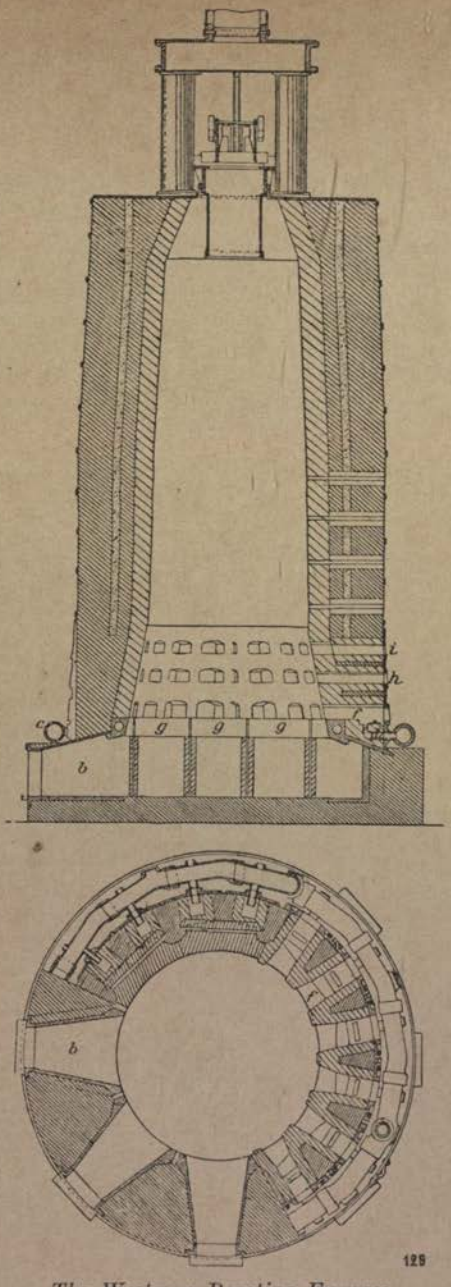
The roasting process, as everyone knows, is intended to remove certain useless or injurious bodies (water, carbonic acid, sulphur) out of the ore, to render the ore more porous and easily crushed, and to increase the degree of oxidation in certain ores, so that they may be more easily reduced in the blast furnace.

Formerly the roasting had been carried out in open "roasting stalls" *rostbås.* These were now replaced by special furnaces, *rostugnar,* or *roasting furnaces,* which were heated with wood or with blast-furnace gas. These furnaces were gradually more and more improved, until Director *E. Westman* in 1850 introduced his well-known, admirably designed roasting furnace, which is greatly responsible for the excellent quality of the Swedish iron.

In the fifties a number of improvements were made in the actual build of the blast furnaces: the heavy walls hitherto in use were replaced by those of a lighter construction, and for this purpose the upper part was built of brickwork and of a circular shape etc.

A figure shows the appearance of a Swedish blast furnace from the fifties.

When the blast furnaces were made larger and the hearth of the furnace wider, it became necessary to distribute the blast more effectively, by using a larger number of tuyeres. The older blast furnaces had only *one* tuyere, but afterwards their number was increased to two, three, and finally four. More than four could not be arranged in the furnace, as long as the shaft rested on bulky corner pillars of hewn stone. Hence in the seventies the plan began to be adopted of erecting the upper shaft on iron supports *(bördjärn)* resting on cast iron columns or trestles, as had long been the practice in coke blast

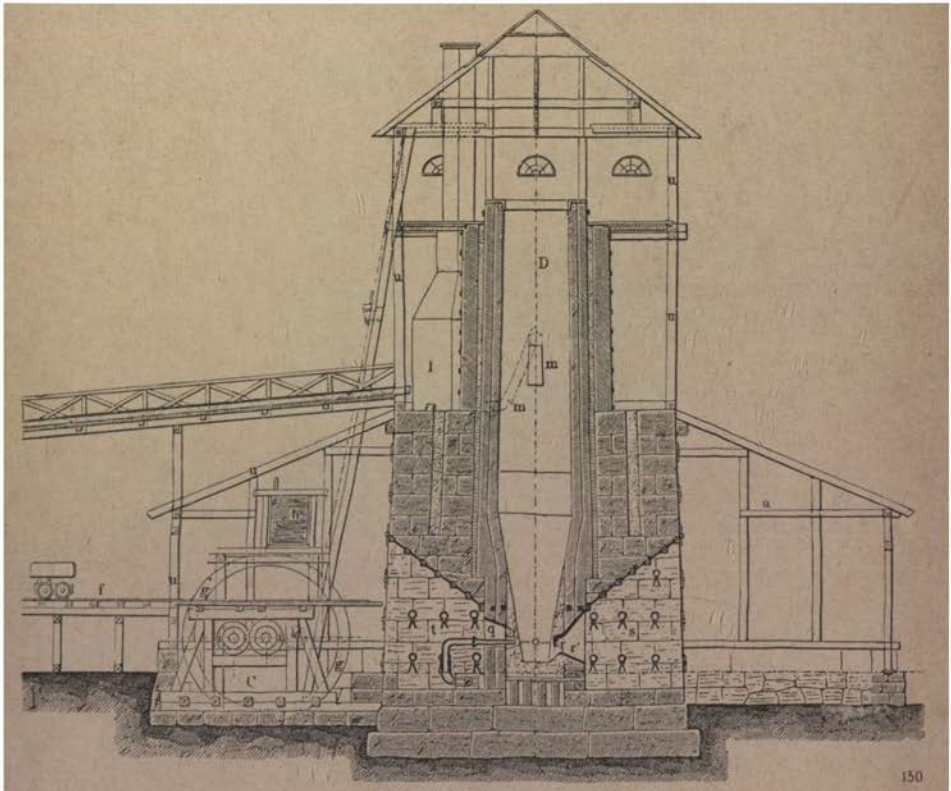


The Westman Roasting Furnace.

furnaces abroad. In 1876 the first blast furnace constructed on this principle was erected, and this method was adopted in most of those built after that time. In 1913 there were 19 blast furnaces equipped with six tuyeres. In 1910 one was built with 5 tuyeres.

The blast furnaces constructed in the last twenty or thirty years have a height of from 16 to 18 meters.

When blast-furnace gas came into use in the thirties as fuel gas for hot-blast stoves and roasting furnaces, the gas was extracted through one or more openings in the furnace wall, situated 4 to 5 meters down in the flue (see *m* in the Figure below). In the sixties the method of gas extraction was improved: from the upper part of the shaft, the throat *(uppsättningsmålet)*, a sheet-iron cylinder from 2·5 to 3 meters in height was suspended down the shaft: this cylinder was termed the *gas-collector cylinder*. The gas mounted behind this cylinder to openings in the wall, and from these openings proceeded the gas pipes to the roasting furnace, hot-blast stove, etc. This arrangement has proved to be extremely effective. In all open blast furnaces the gas is now extracted in this manner. However, *closed charging devices (slutna uppsättningsmal)* have been coming more and more into use in recent years. About half the blast furnaces now in work are thus constructed.



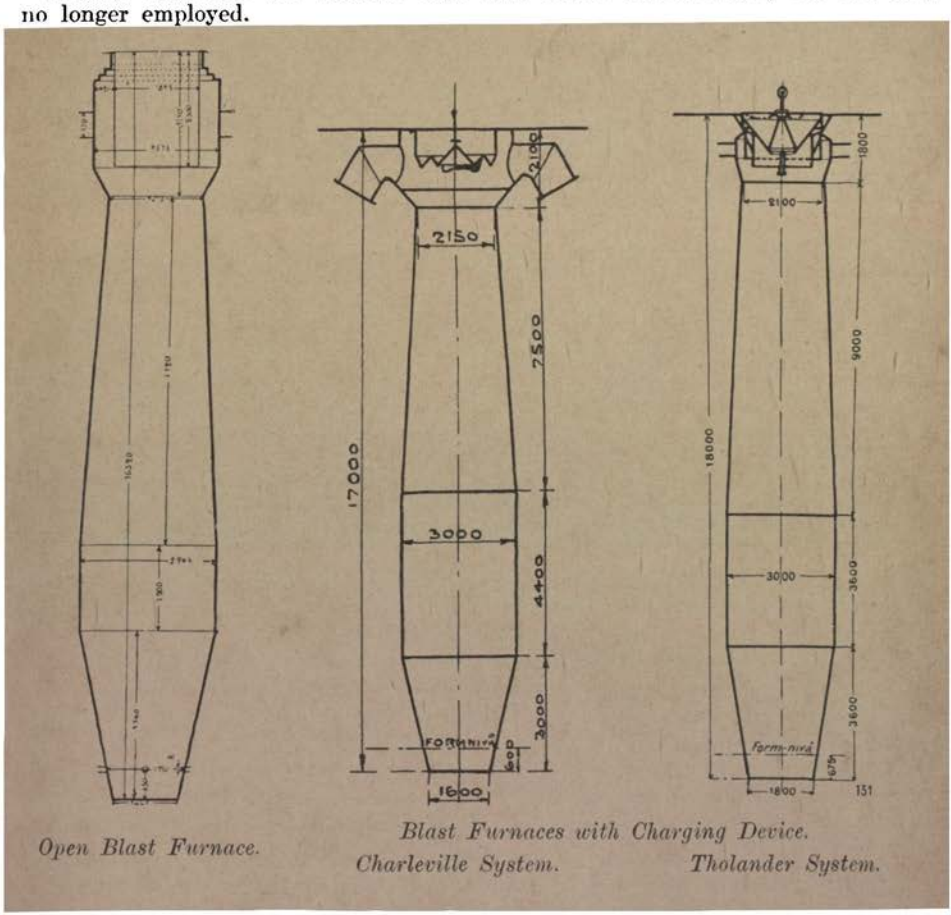
Swedish Blast Furnace from 1850.

Charcoal is always charged into the furnace in fixed quantities; the charcoal-charge (technically called the *kolsättning)*, varies according to the size of the furnace, the normal amount being from 14 to 16 hectoliters.

As early as 1835 35 Swedish blast furnaces were equipped with *hot-blast stoves*. All of them were on the Wasseralfinger system (horizontal iron pipes) and very small, giving a blast temperature of only from 150° to 200° Celsius. When pig iron began to be made for the Bessemer process, the need of hotter

blast became urgent. In order to meet this need, hot-blast stoves were constructed with vertical pipes, on the Gjers system, and also of improved Wasseralfinger type. The latter are now very common; with them a constant temperature of 400° and an occasional temperature of 500° Celsius can easily be obtained. "Regenerative" stoves are used only at Degerhamn, Domnarvet, Björneborg, and Avesta. The *blast pressure* (for charcoal) is usually from 50 to 100 millimeters of quicksilver.

Drying apparatus for charcoal came into use in the seventies, but are now no longer employed.



Open Blast Furnace.

Blast Furnaces with Charging Device.
Charleville System. *Tholander System.*

The *pig iron* made obviously differs in quality according to the purpose for which it is to be employed.

As has been previously mentioned, the cast iron needed for home requirements is imported; only a small quantity is made in Sweden.

Owing to the complete roasting of the ores and the freedom of the charcoal from *sulphur*, the Swedish pig-iron is very free from sulphur; the sulphur contained in it seldom amounts to 0·03 %, it generally keeps below 0·02 %, and it frequently descends to about 0·01 % and under.

The *phosphorus*-content is also, as a rule, low; but, as in Sweden there is a plentiful supply of ores rich in phosphorus as well as ores poor in phosphorus, pig iron may be made at pleasure with the most varying phosphorus-contents, ranging from the iron rich in phosphorus needed for the basic Bessemer process,

to iron containing only about 0·01 % of phosphorus. A large number of ores in Central Sweden, for instance certain Dannemora ores, etc., and also certain concentrated ores, contain merely from one to two thousandth per cent of phosphorus. When smelted with charcoal, practically free from phosphorus, these ores yield a pig-iron with from 0·012 to 0·015 of phosphorus. The fact is that the pig-iron absorbs from the charcoal a certain amount of phosphorus, as a rule from 0·010 to 0·015, occasionally less (the amount of phosphorus in charcoal made in kilns from barked and floated pine-wood is extremely low).

Pig-iron intended for Bessemer and acid Siemens-Martin usually contain from 0·020 to 0·030 % of phosphorus.

Several magnetite ores in the midlands of Sweden contain from 1 to 5 % of *manganese* and a very trifling amount of phosphorus; they yield a pig-iron of very superior quality, especially for the Bessemer process.

In 1865 *spiegeleisen* with from 12 to 18 % of manganese began to be worked at Schisshyttan. The fuel was a mixture of coke and charcoal and the charge a magnetic iron ore, containing knebelite.

The *consumption of charcoal* per ton of pig-iron in the Swedish blast furnaces varies considerably according to the quality of the charcoal and the ores, and according to the kind of iron it is desired to produce. At present it is from 45 to 75 hectoliters, but the average consumption for the whole country, not counting the iron made with coke, was in 1913, according to the official statistics, 57·7 hectoliters. In 1912, 1911, 1910, 1909, and 1908 the consumption was 59·2, 61·2, 62·8, 63·4, and 63·6 respectively. Thus the consumption of coal is decreasing, thanks to the improved construction and operation of the blast furnaces.

Manufacture of Pig Iron by Electricity.

The following figures give the quantities of iron made in Sweden in electric blast-furnaces (see Table 53):

Year	1908	1909	1910	1911	1912	1913
Tons	122	302	890	5 786	17 561	31 916

At the beginning of the year 1914 there were 5 electric blast furnaces at work in Sweden (one at Trollhättan, one at Domnarvet, three at Hagfors). Besides this, one was projected to be built at Söderfors and two at Hagfors. Each of these furnaces have a power of from 2 000 to 3 000 kilowatts.

The idea of producing pig iron by the reduction of iron ore in electric furnace is not a novel one in Sweden. That this idea should arise in Sweden was quite in the natural course of things: no country possesses the necessary conditions — a plentiful supply of comparatively cheap water-power and rich pure ores — in a higher measure than does Sweden. Moreover, the increasing difficulty of obtaining charcoal at reasonable rates in conjunction with great developments in electricity brought matters to a head, and people addressed themselves in earnest to tackle the knotty problem.

The engineers *A. Grönwall*, *A. Lindblad*, and *O. Stålhane* at Ludvika formed a company under the name of Aktiebolaget Elektrometall, one of the objects of which was to construct an electric furnace suitable for the reduction of iron

ore. They succeeded in interesting in their schemes the Manager of the Stora Kopparbergs Company, *E. J. Ljungberg*, and Major-General *G. Geijer* of the Grängesberg Company. With the financial support of these great companies smelting experiments were commenced in the spring of 1907 at Domnarvet.

After several different types of furnace had been tested without result, a furnace was finally constructed, consisting of a shaft 5·2 meters in height, placed above a smelting chamber 1·5 meters in height and with an interior diameter of about 2·25 meters at the greatest width. Through the vault of the smelting chamber there passed three carbon electrodes with a section of 660 by 330 millimeters. The current employed was a three-phase current of 25 periods.

The furnace was started on the 7th of May 1909 and ran continuously, apart from minor interruptions, until the 30th of July of the same year, when for certain reasons the smelting had to be terminated. With an average load of 496 kilowatts the output during this time was about 280 tons of pig-iron, the consumption being 354·1 kilograms of charcoal and coke, 3 181 kilowatt-hours, and 30 kilograms of electrodes (gross amount) per ton of iron.

"Jernkontorets Försöksverk" at Trollhättan. — Electric Blast Furnace.

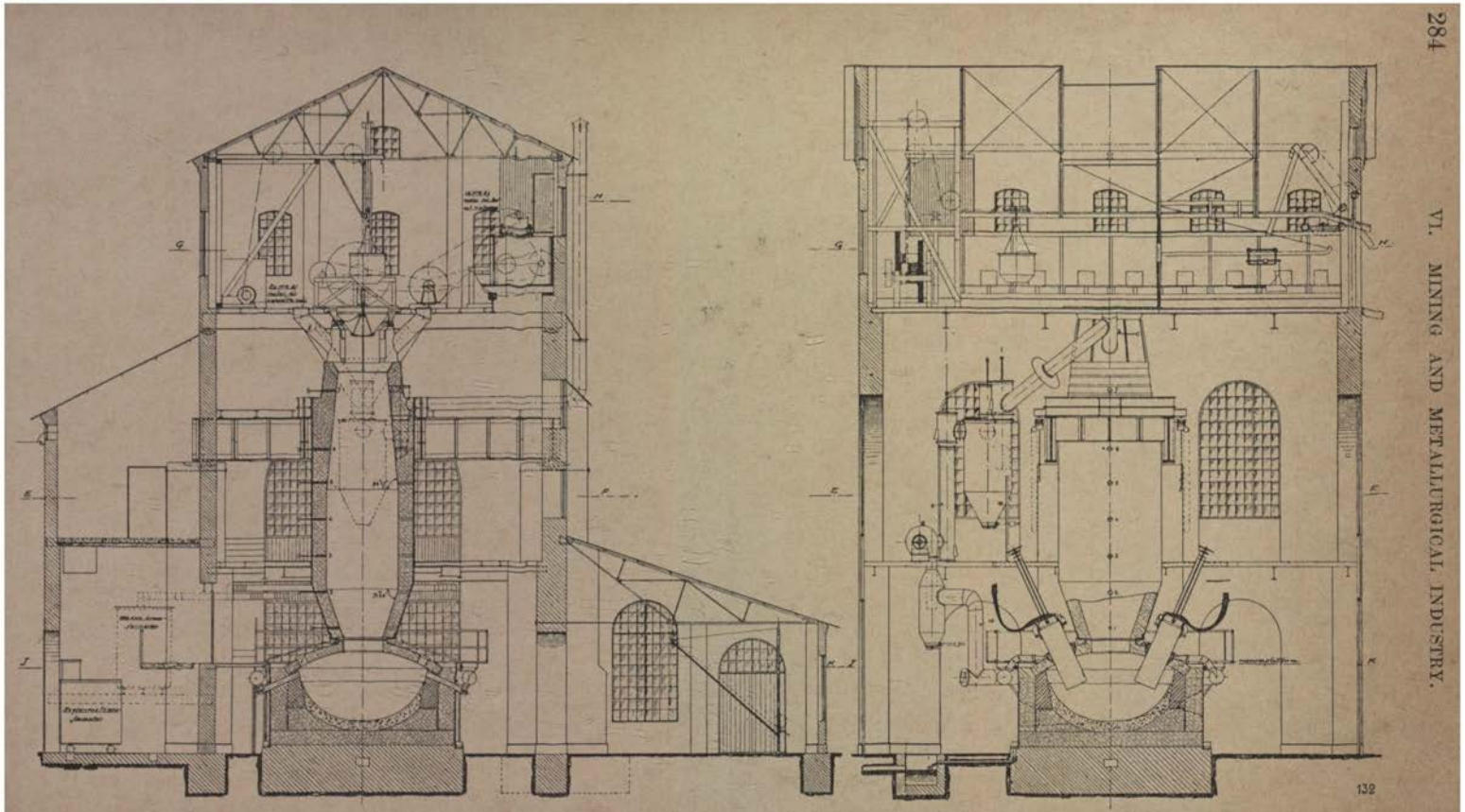
Considering all the difficulties and troubles with which a first experimental working is invariably attended, the results thus obtained were found sufficiently satisfactory to warrant an application to Jernkontoret, The Corporation of Ironmasters, that Jernkontoret should take the matter in hand, and by dint of experiments on a large scale, endeavour to conduct the problem to a satisfactory solution.

Jernkontoret did so, and on the 15th November 1910 the furnace at Trollhättan (Jernkontorets försöksverk) was started.

The furnace consists of two parts, the smelting chamber and the shaft, both of which are surrounded with stout plate jackets and lined with Chamotte bricks. The shaft is suspended from strong iron beams, which are carried by the walls of the furnace house. The total height of the furnace from the bottom of the smelting chamber to the upper floor is 12·7 meters, the greatest interior diameter of the shaft 2·2 meters, the greatest interior diameter of the smelting chamber about 4 meters, its height about 2 meters, and the whole capacity of the furnace about 40 cubic meters.

Down through the vault are passed 4 carbon electrodes, 660 millimeters square (now 600 millimeters in diameter), which form an angle of 65° with the horizontal line. The current — three-phase, 10 000 volts, 25 periods — is transformed in two transformers, each of 1 100 kilovolt-ampères, to two-phase with a tension of from 50 to 90 volts.

With the aid of a fan, gas is sucked from the upper part of the shaft and



The Electric Blast Furnace of Jernkontoret at Trollhättan.

pressed through four nozzles into the smelting chamber. The object of this gas circulation is partly to cool the vault and thereby protect it from deterioration, partly to convey heat from the smelting-chamber up into the shaft, in order thus to aid the preheating of the metal and the reduction of the ore with carbon monoxide.

The work in this furnace is conducted as in an ordinary blast furnace.

In the course of the experimental period, from 15 November 1910 to 30 September 1912, a large number of Swedish rock ores, and also slick and briquettes from different localities were put to the test. Experiments were moreover made with coke as a reducing agent, but without success. Altogether 13 660 tons of ore, slick and briquettes and 1 101 tons of limestone were smelted, and 8 450 tons of pig-iron were produced. On an average for the whole period 23·14 hectoliters of charcoal were consumed per ton of iron, and 3·84 tons of iron were produced per kilowatt-year read off on the dial (= 2 280 kilowatt-hours per ton of iron). The consumption of the electrodes during the third campaign was about 4·5 kilograms per ton of iron, and is the present moment of writing about the same.

The experiments made at the works have carried the problem of the electric reduction of iron ore a good step forward. They have shown that the Swedish iron industry has much to gain along this line, and that in the electric blast furnace it has obtained an excellent new weapon for its struggle in the world's market.

The saving of charcoal which may be counted on in electric blast furnaces, is from 55 to 65 % of the consumption in ordinary blast furnaces.

The Manufacture of Spongy Iron.

Under the heading "Coal" it has already been mentioned, that "*spongy iron*" *(järnsvamp)* has in quite recent years been prepared at Höganäs.

This industry was started on experimental lines during the latter half of 1909, and the results obtained both at Höganäs and also when the spongy iron was used in a Siemens-Martin furnace (for the first time at Lesjöfors in January 1910) led to the construction of a special reducing furnace for the further elaboration of the method. The line thus entered upon was afterwards pursued. The output of spongy iron at Höganäs in 1911 was 3 772 tons with an average value of 226 320 kronor. In 1912 the output was 3 979 tons with a value of 242 719 kronor, and in 1913 6 073 tons with a value of 384 420 kronor were made.

The preparation of spongy iron in accordance with *E. Sieurin's* method has hitherto been based essentially on the use of iron ore slick, obtained by the concentration of Gällivare gangue ore, and on the use of the inferior ashy coal of the Höganäs Company. The said slick contains from 71 to 71·5 % of iron, from 0·008 to 0·009 % of phosphorus and 0·002 % of sulphur.

The reduction process is carried out in the following manner: alternating layers of slick and coal dust are heated in closed brick cases, which are placed in a circular furnace of the same kind as is used for burning bricks, heated with producer gas. When the reduction has been completed, the cases are allowed to cool, after which they are removed and emptied; the spongy iron is then me-

chanically separated from the reducing agent. The silicon and phosphorus impurities in the latter remain unreduced, and the bulk of the sulphur is bound with lime and is removed along with the ashes, as well as the impurities mentioned.

Spongy iron made from the above-mentioned Gällivare slick contains 96·5 % of metallic iron, 1·6 % of ferrous oxide, 0·010 % to 0·030 % of sulphur and 0.013 % of phosphorus. The specific gravity of the spongy iron is 2 to 2·5, and it thus contains up to 70 % of pores. By severe pressure the specific gravity can be raised to 4·5 or 5.

Spongy iron is used with advantage as a substitute for wrought iron scrap in Siemens-Martin furnaces. Moreover, rather extensive experiments have been made to smelt it in Lancashire hearths. Attempts have also been made in German chemical factories to use the spongy iron for reducing purposes.

The supplies of coal which the Höganäs Company has available for the immediate future for the preparation of spongy iron, will probably allow of an annual output of up to 200 000 tons.

The Manufacture of Wrought Iron.

The production of wrought iron in Sweden during the last 35 years is shown by the Table 55.

It will be seen from the Table that the output of wrought iron has diminished in the course of the last 25 years. The reasons of this decrease are firstly that this industry is entirely dependent on the price of charcoal, which is constantly rising, secondly, that the soft ingot metal (Bessemer and Martin) has entirely or partially ousted wrought-iron for a number of uses.

However, if the wrought iron industry has declined, it is not for lack of efforts to keep it alive. On the contrary, much labour has been expended and much interest has been lavished both on the production of the pig iron intended for the fining (hotter blast, more basic slag, richer charges and faster driving of the blast furnaces) and also on the actual finery process. With regard to the latter, the *Lagerwall* machine (1895) for breaking up the iron mass (first used at Laxå) effected quite a revolution in the Lancashire process. These machines rendered possible the use of hotter blast and larger charges, without entailing heavier

TABLE 55. *Output of Wrought Iron in Sweden.*

Annually	Tons	Annually	Tons	Annually	Tons
1876—80	116 125	1896—00	192 147	1912	148 828
1881—85	153 495	1901—05	183 031	1913	153 400
1886—90	205 945	1906—10	155 468		
1891—95	215 770	1911	146 722		

TABLE 56. *Number of Forging Hearths and Puddle Furnaces employed.*

Annually	Scrap smelting hearths	Wallon hearths	Franche-Comté hearths	German hearths	Puddling furnaces	Lancashire hearths	Total
1891—95	10	25	43	—	4	328	**410**
1896—00	15	23	18	1	4	287	**348**
1901—05	13	25	13	—	3	275	**329**
1906—10	8	22	5	—	1	239	**275**
1911	7	22	4	—	—	199	**232**
1912	8	21	3	—	—	201	**233**
1913	10	21	2	—	—	202	**235**

labour on the part of the workmen: an increased output was thus thereby obtained, while a saving of iron, charcoal and labour was effected.

Export of Wrought Iron. See the Table 57. It may be said, that by far the greater part of the wrought iron produced is exported in the form of "bar iron" *(stångjärn)* or "rough bars" *(råskenor)*, but also to some extent in the shape of blooms *(smältstycken)*.

Import of Wrought Iron. There is no import of wrought iron into Sweden.

The chief Processes used in the Manufacturing of Wrought Iron. A brief account of these processes is furnished below.

The most ancient known method of preparing malleable iron (wrought iron) in hearths from pig iron was that known as *tysksmide*, or "German forging" which was introduced into Sweden at the beginning of the seventeenth century.

This kind of forging was performed in an open hearth composed of coarse cast-iron slabs, in which the pig iron was melted down with charcoal. After the smelting it was broken up from the bottom of the hearth with heavy iron bars in order to be remelted, and this operation was sometimes repeatedly performed. The silicon and carbon in the pig-iron was oxidized in the smelting, and a lump *(smälta)* of soft slaggy iron was obtained. The latter was belaboured with a heavy hammer, and afterwards cut up into smaller pieces, called *smältstycken* or "blooms".

In a "German hearth" *(tyskhärd)* 2 to 3 tons of bar iron were produced per week with a consumption of more than 200 hectoliters of charcoal per ton. The waste was 18 %.

The method was gradually improved.

An improved process was introduced in 1740 from France under the name of *Wallonsmide* or Walloon forging into the Dannemora mining district, where it is still

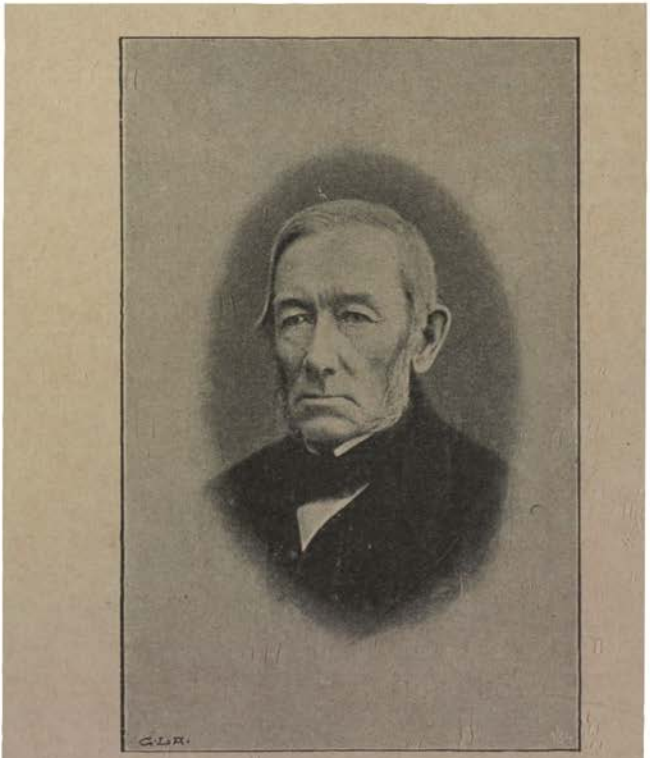
TABLE 57. *Export of Wrought Iron.*

Annually	Blooms and rough bars tons	Bar iron tons	Annually	Blooms and rough bars tons	Bar iron tons
1891—95 . . .	11 616	168 563	1911	27 600	129 200
1896—00 . . .	21 453	166 626	1912	35 500	131 200
1901—05 . . .	21 740	172 680	1913	39 500	129 400
1906—10 . . .	26 380	143 780			

practised. The Walloon hearth is, like the German hearth, open, but considerably smaller.

In this process is employed pig iron made with cold-blast; the pig-iron is cast in sand in pigs, called "*gösar*", having a semicircular cross-section, and these pigs are about 5 meters long, and have a weight of from 800 to 1 000 kilograms. The pigs are pushed from behind into the hearth, up to the tuyere, and are there covered with charcoal. After the smelting, the metal is broken up in the usual manner. The small lumps are cut up into blooms, which are welded and then hammered out under a hammer.

In this process the phosphorus and sulphur contained in the iron is removed to a remarkable extent.



G. Ekman.

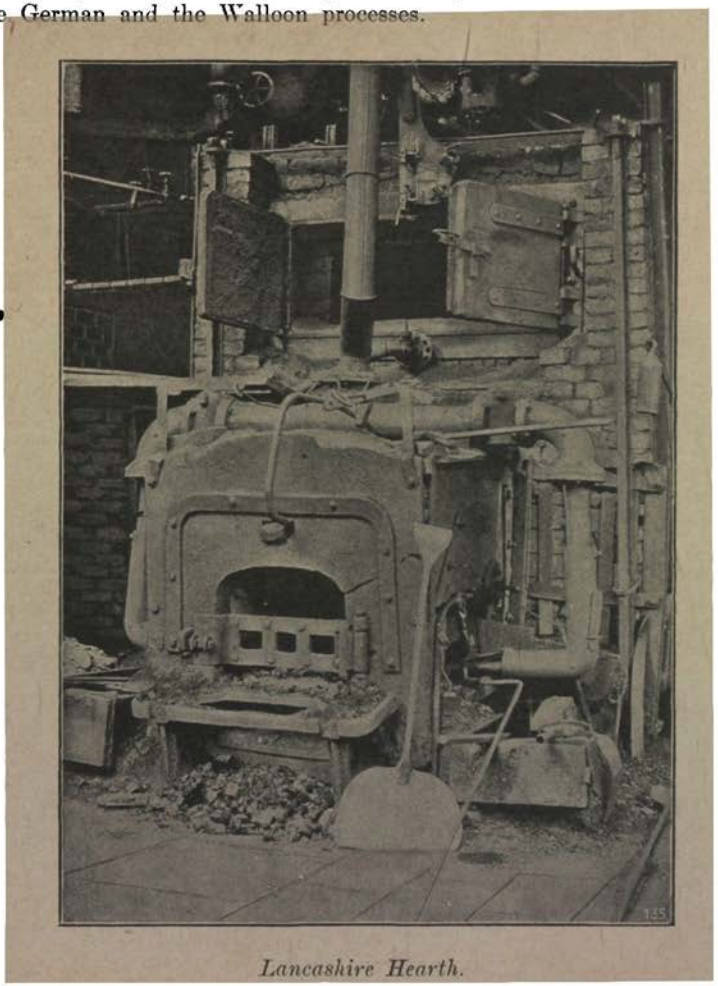
Walloon iron is used only for the preparation of blister steel, which is then smelted in crucibles (crucible steel).

The consumption of fuel is about 150 hectoliters of charcoal per ton of bar iron. About 1·5 tons of bar iron a day is the output per hearth, the waste (*avbränning*) being about 25 %. This iron is therefore very expensive to make.

The *Lancashire Process*. In the twenties of the nineteenth century a very important improvement was made in the construction of the forging hearths. In lieu of the open hearth hitherto in use, the actual smelting-chamber was surrounded with cast-iron slabs, and furnished with a firebrick arch as a roof, so that the hearth was closed, and provided with only one working opening. The bottom of the hearth was kept cooled by a tank of water placed under it, and

finally there was arranged behind the hearth a heating chamber for the pig iron. The latter was in that chamber preheated to redness with the combustion gases proceeding from the hearth, before it was pushed down into the hearth to be smelted.

These arrangements effected a great saving in fuel and time as compared with the German and the Walloon processes.



Lancashire Hearth.

In Sweden the new forging process particularly attracted the attention of *G. Ekman*. He undertook several journeys to England in order to study it, he called in English smiths, and made experiments, first at the Söderfors Works in 1831, and then on a larger scale at the Liljendahl Works in 1836. From this time this process, which was designated *lancashiresmide*, and which has played, and still plays, an important part in the Swedish iron industry, may be considered to have got itself established in Sweden.

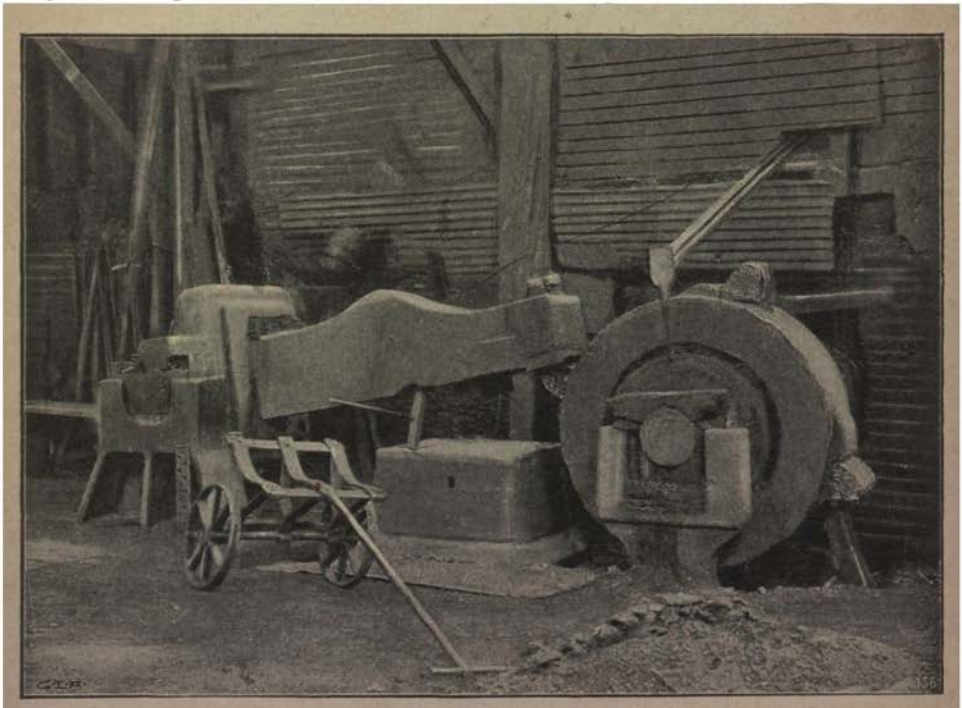
The accompanying figure shows the look of a Lancashire hearth with 2 tuyeres.

The hearth has sometimes one, more rarely three, frequently two tuyeres, placed opposite one another, on either side of the hearth. The blast pressure

is from 90 to 120 millimeters of mercury. Nowadays hot-blast is always used: it is obtained from a small hot-blast stove, which lies in the path of the escaping gases.

The main features of the Lancashire process are as follows:

Each charge consists of from 140 to 150 kilograms of iron in flat pigs, previously heated in the heating chamber. These pigs are raked down into the hearth, which is filled with charcoal to a level slightly above that of the tuyeres, whereupon they are covered over with charcoal, the blast is turned on and the smelting begins. As the charcoal burns away, fresh coal is thrown on. From time to time a little water is sprinkled on the coals with a dipper, in order to relieve the workman from the intense heat, and also to prevent the carbonic oxide from burning away before it enters the heating chamber. The charcoal employed has previously been washed free from sand and earth; this obviously renders the charcoal moist, but is actually an advantage for the process.



Shingling Hammer.

When all the iron has been smelted and collected on a bedding of hearth slag previously spread on the bottom of the hearth, the breaking-up process begins. This work is performed in the manner indicated with respect to the German process — though nowadays as a rule with the aid of the Lagerwall machine — and goes on until the carbon, manganese, and silicon contained in the pig-iron have been reduced to a minimum, and lumps of soft iron called *färskor* have thus been obtained. These are finally melted and welded together into a larger ball called *smälta* which is removed from the hearth, and under the blows of a largish hammer called *smälthammare* or *mumblingshammare* ("shingling hammer") is first pounded out and then divided into smal-

ler pieces. The latter are sometimes immediately rolled out into bars, which are then termed *råstänger* or rough-bars. But, if a superior, more slagless iron is to be made, they will have to be heated anew (welded) in hearths or heating furnaces and are thereupon either hammered into bar iron under a smallish hammer (termed *räckhammare* or extending hammer), or rolled under rollers.

Pig iron to be suitable for Lancashire forging should be white or mottled and contain: 0·2 to 0·3 % of silicon, 0·2 to 0·3 % of manganese, 0·005 to 0·010 % of sulphur, 0·05 to 0·07 % of phosphorus, and 4 to 4·25 % of carbon.

The usual consumption per ton of blooms is from 25 to 35 hectoliters of charcoal and from 1 100 to 1 150 kilograms of pig iron. The output per hearth with two tuyeres a week is as a rule 15 or 16 tons of blooms.

The Manufacture of Blister Steel.

Manufacture of blister steel during the period from 1891 to 1913. See Table 58.

TABLE 58. *Output of Blister Steel in Sweden.*

Annually	Tons	Annually	Tons
1891—95	797	1911	436
1896—00	920	1912	425
1901—05	795	1913	196
1906—10	410		

The output, as will be seen, is very small and has been steadily declining. In 1913 there were 3 cementation furnaces in use (2 at Österby, 1 at Svanå).

Blister steel is used chiefly as a raw material in the manufacture of crucible steel.

The Manufacture of Steel.

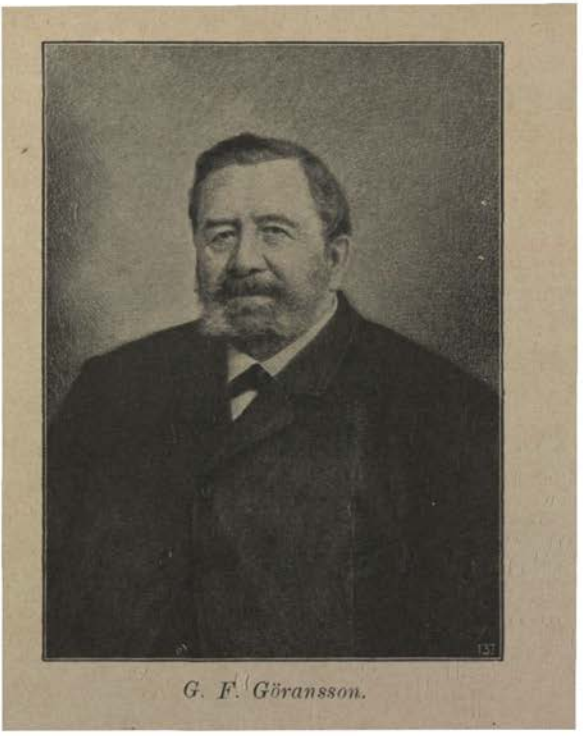
By steel in contradistinction from wrought iron is signified steel and malleable iron which when produced is obtained in a molten condition.

The preparation of ingot iron (steel) is carried out in different manners: in Bessemer converters, in Siemens-Martin furnaces, in crucibles, and in electric furnaces.

In Sweden the Bessemer process was first used in 1858, the Uchatii method of crucible smelting in 1860, the Siemens-Martin process in 1868, crucible smelting in the ordinary sense of the term in 1871 and electric steel smelting in 1900.

The Bessemer Process. Although this process bears the name of its inventor, Henry Bessemer, an Englishman, it may be said to be the fruit of Swedish work. It was in Sweden and by Swedes that it was elaborated and rendered practicable, and therefore the history of this process will always be of very special interest to Sweden.

The leading idea of the Bessemer process is for the fining of the pig iron to use only (1) the heat residing within the metal itself when in a molten state (2) the heat generated when the blast sent through the molten pig iron burns away the bodies (carbon, manganese, silicon, phosphorus), which it is the object of the fining entirely or partially to remove.



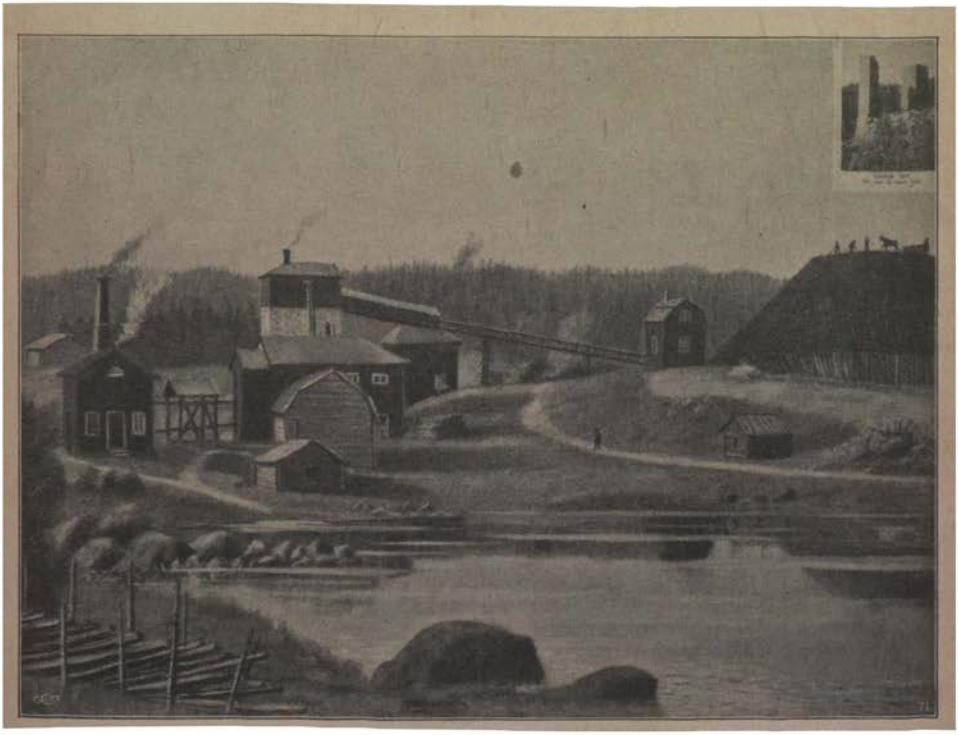
G. F. Göransson.

In 1855 and 1856 Bessemer had achieved such small success in carrying his process into effect, that in England its prospects were regarded as practically nil. No better success attended the experiments made at Dormsjö in 1857 under the superintendence of a Swedish engineer, *John Leffler,* and at the instigation of the proprietor of the works, *Pontus Kleman.* Despite all this, Bessemer's patent was bought in Sweden by Consul *G. F. Göransson,* who embarked on his experiments in November of that year, at Edsken, with the assistance of the engineers *C. Lundvik* and *C. P. Lindberg.*

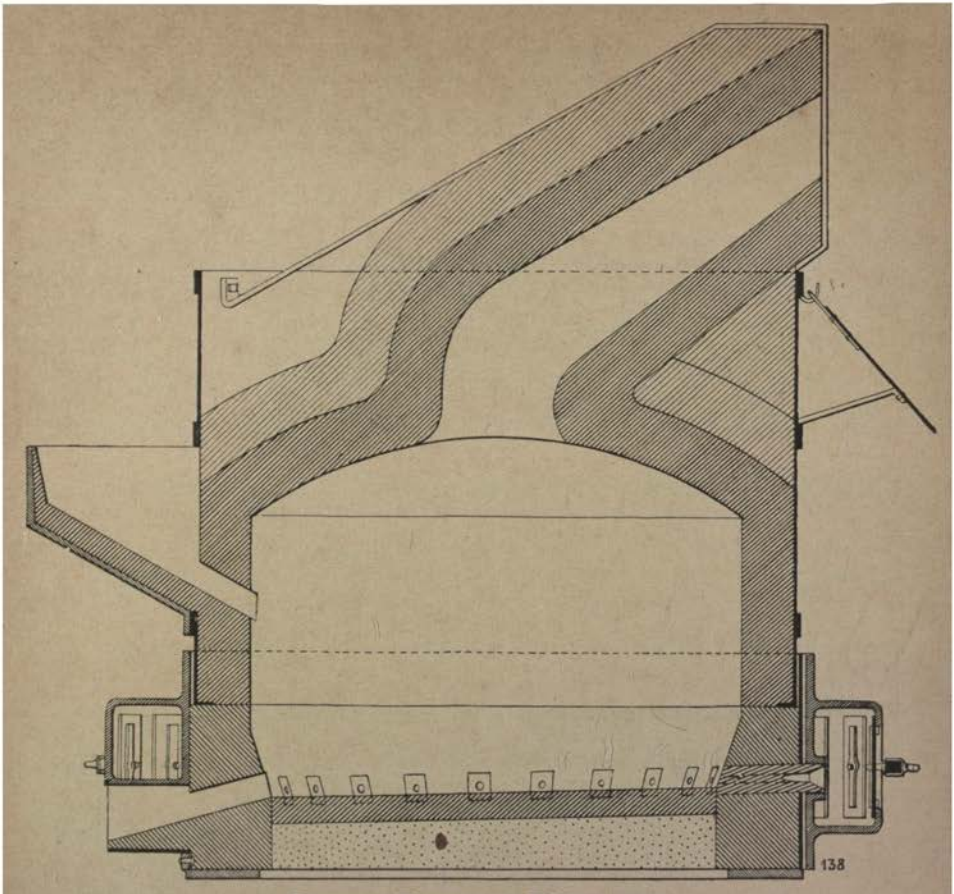
At Edsken was employed, to begin with, the same furnace that had been used at Dormsjö; but afterwards a new Bessemer furnace was constructed, likewise after Bessemer's designs. This furnace was a perpendicular stationary furnace with two rows of tuyeres placed round the furnace near the bottom. The results, however, were far from encouraging: the steel, as a rule, flowed sluggishly, and could be only partially tapped from the furnace or ladle. Göransson accordingly had the furnace altered with

the object of increasing the area of the tuyeres, and thus the amount of the blast per unit of time. In the furnace thus improved (see the Figure, next side) was carried out on the 18th July 1858 the first completely successful Bessemer steel blowing. The problem was solved. One now obtained an easily flowing steel, easily tapped, which exhibited excellent qualities when subjected to the test forging. The successful issue of the experiments revived people's faith in the Bessemer process. It was carried on at Edsken until March 1866, when these works were shut down. In the meantime the Högbo Company had been constituted with Göransson as its manager, and in 1862 and the year following this Company built a new iron work, Sandviken, with a Bessemer plant. It was here that the first Swedish tilt furnaces or converters were erected, and the blowings were superintended by the engineers, *C. Lundvik* and *O. Kollberg*. The latter subjected the process to a thorough scientific analysis, and ascertained the conditions under which it could be most effectively carried out.

Once elaborated at Edsken, the process was introduced into several other Swedish iron works. It was deemed particularly well adapted for Sweden, with her pure ores and her abundance of water power for driving the blowing engines. At first stationary furnaces were every-



Edsken. The first Bessemer Works in the World (1858).
(The little vignette in the right hand corner shows the present aspect of Edsken).

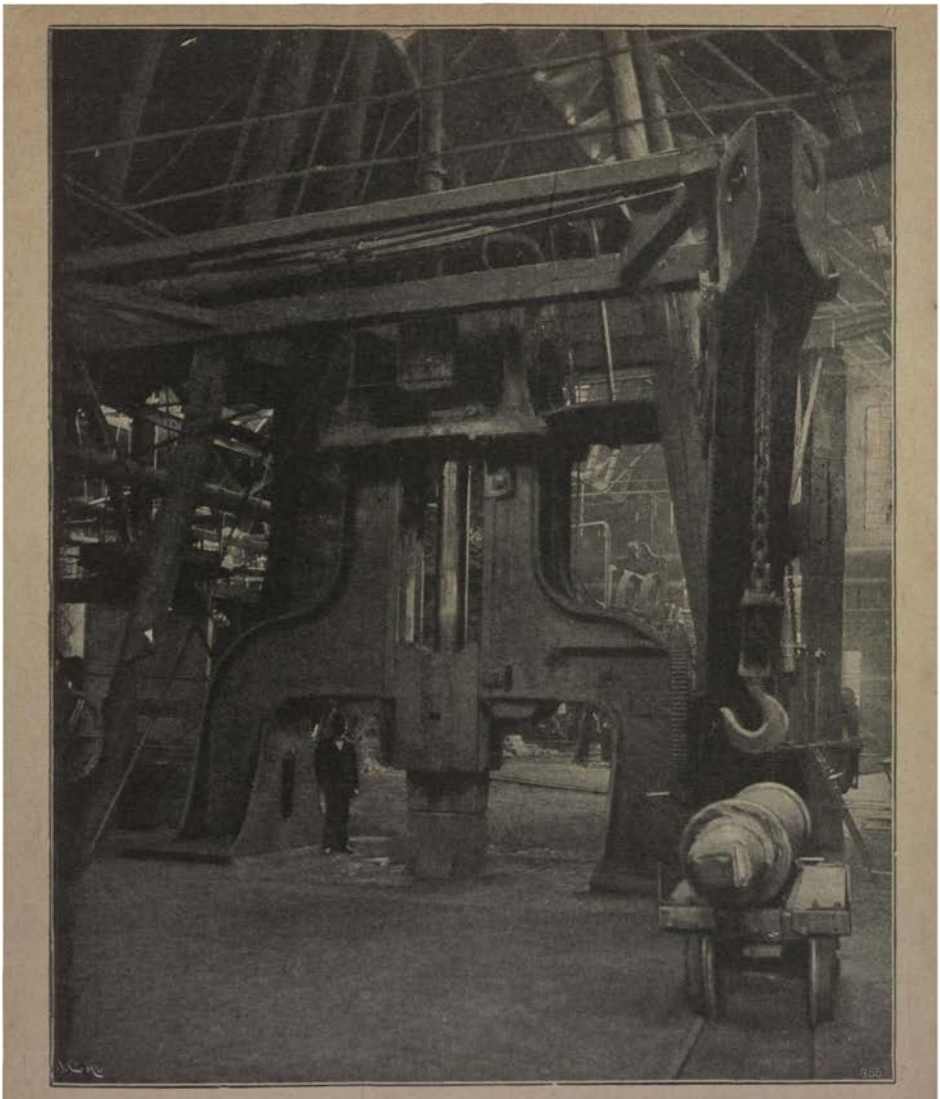


Bessemer Furnace at Edsken, 1858.

where constructed. However, this impeded the development of the process: the stationary furnaces proved very awkward to handle and had a number of other defects. The result was that several Bessemer works which had already been constructed were abandoned, partly at any rate for these reasons. At Sandviken, on the other hand, the work went steadily forward. Arrangements were made there for working up the

TABLE 59. *Output of Bessemer Steel in Sweden.*

Annually	Acid tons	Basic tons	Total tons	Annually	Acid tons	Basic tons	Total tons
1861—65 . . .	2 292	—	**2 292**	1896—00 . . .	74 235	27 168	**101 403**
1866—70 . . .	3 666	—	**3 666**	1901—05 . . .	47 295	33 156	**80 451**
1871—75 . . .	14 665	—	**14 665**	1906—10 . . .	38 730	42 001	**80 731**
1876—80 . . .	21 975	—	**21 975**				
1881—85 . . .	47 976	—	**47 976**	1911	41 116	52 737	**93 853**
1886—90 . . .	73 102	—	**73 102**	1912	43 317	63 937	**107 254**
1891—95 . . .	79 822	8 267	**88 089**	1913	45 069	70 770	**115 839**



Steam Hammer, Sandviken.

steel ingots into finished articles in various forms, instead of exporting them as ingots. which was becoming less and less remunerative the more Bessemer metal was made abroad.

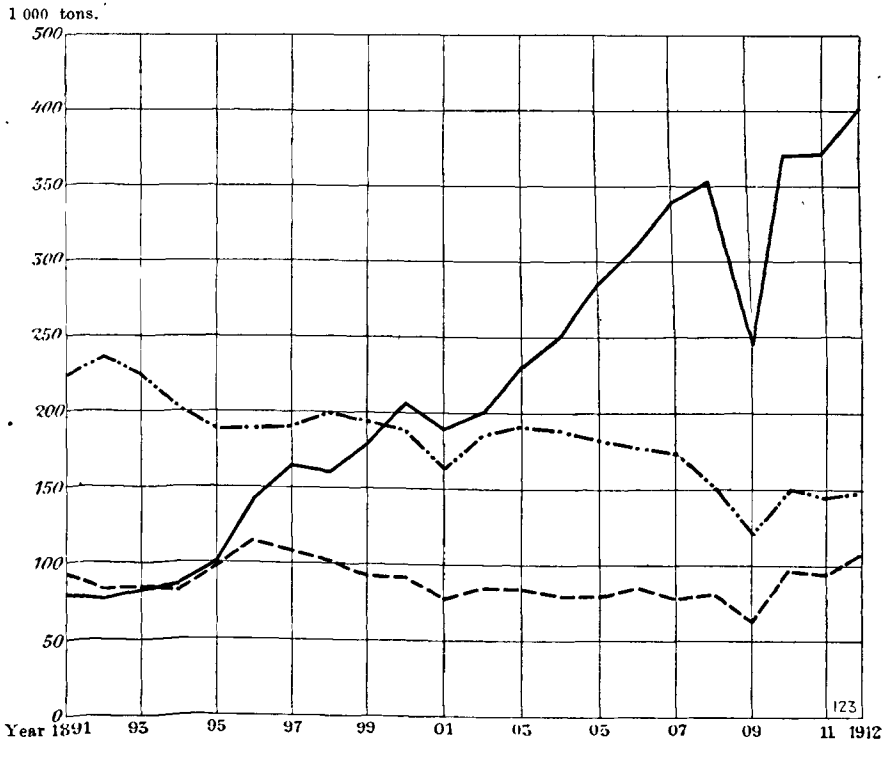
By and by other works followed the example set by Sandviken; at present the Bessemer process is carried on at the following Swedish works: Bångbro, Domnarvet, Forsbacka, Hagfors, Hofors, Iggesund, Långshyttan, Nykroppa and Sandviken, in the two first-named also in the form of "basic Bessemer". The situation of these works is shown by the accompanying map.

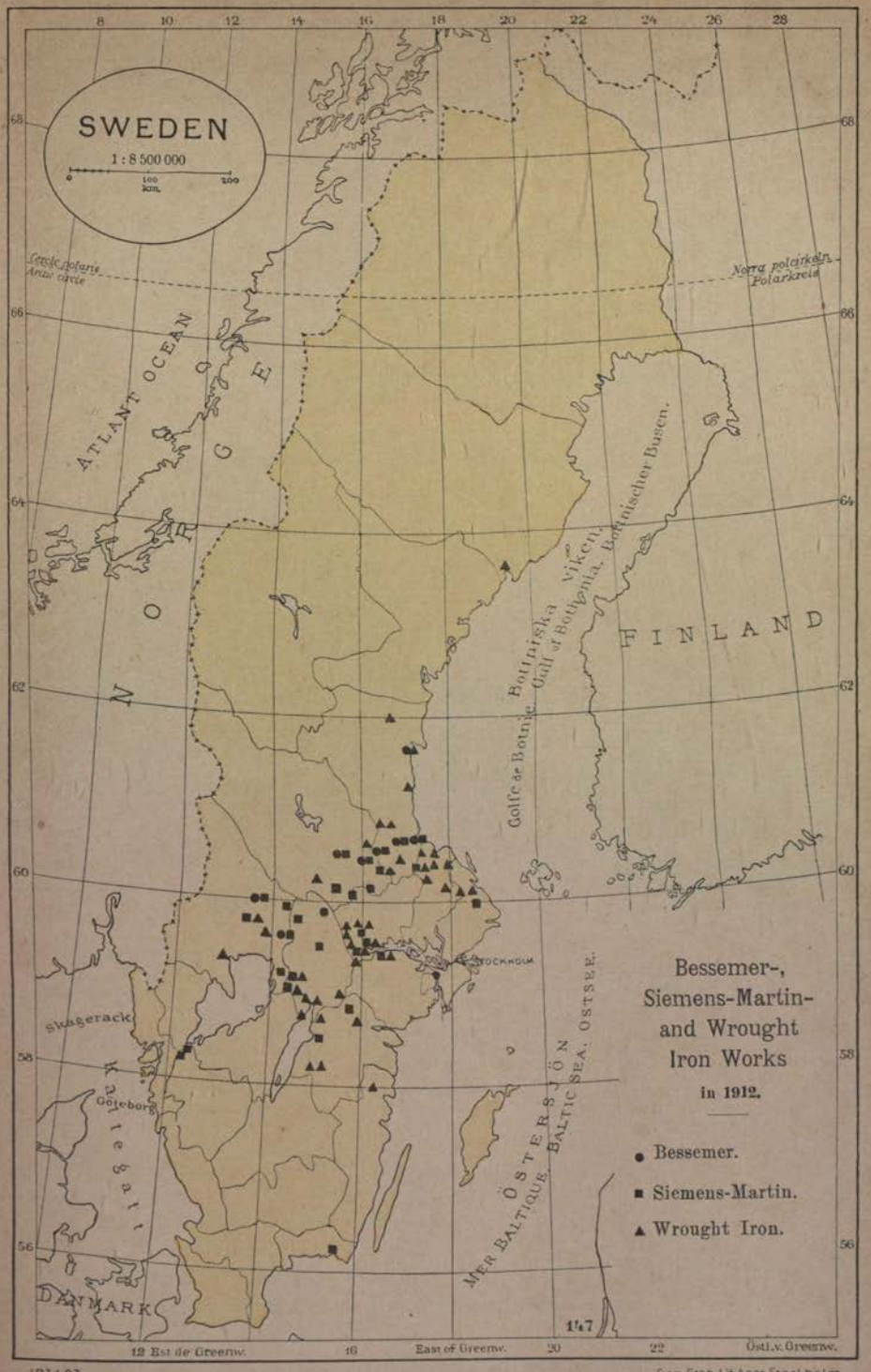
The great importance the Bessemer process has assumed for the Swedish iron industry will be gathered from the figures showing the **output of Bessemer metal** given in the Table 59 and in the diagrams further down.

Excepting 1913 the maximum output was reached in 1896. During the following years the acid process declined, but in quite recent times a fresh advance is noticeable. The basic process has gone steadily ahead.

The reason of the decline of the acid process is the competition of open hearth steel, which is cheaper to produce. Owing to the larger consumption of charcoal for acid Bessemer pig iron, this kind of pig iron has suffered even more than others from the rising prices for charcoal; the result has been that the manufacture thereof has had to be restricted or, in some cases, to be stopped altogether. The advance in 1910 to 1913 seems to be mainly due to the keen demand for Swedish iron and steel in general, but as regards acid Bessemer steel in particular, also to the fact, that a number of purchasers have found it consonant with their advantage to use this quality of steel in face of its higher price.

Output of Wrought Iron, Open Hearth- and Bessemer Steel in Sweden.

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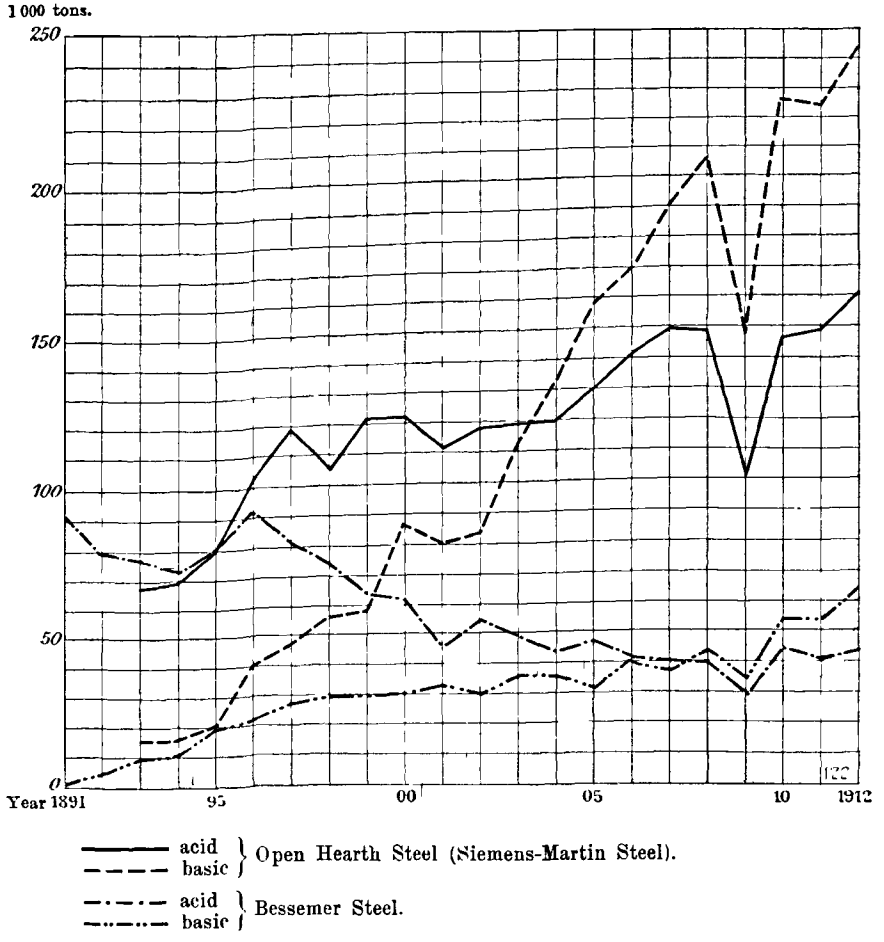
Output of Acid and Basic Open Hearth and Bessemer Steel in Sweden.



The Acid Bessemer Process. In the acid Bessemer process, as carried on in Sweden, is employed a pig iron containing from 2 to 3 % of manganese and from 0·8 to 1·1 % of silicon. The sulphur-content is about 0·010 % and under, and the proportion of phosphorus 0·020 to 0·030 %. The most distinctive feature of the acid process is the relatively high manganese-content and the relatively low silicon-content and, as regards the actual operation, that the pig iron is taken in a molten condition direct from the blast furnace to the converter, thus without previous remelting in a cupola furnace.

Bessemer pig iron, being taken direct from the blast furnace to the converter, demands particularly great care in the making, inasmuch as disturbances in the running of the blast furnace directly affect the composition of the pig iron and its temperature, and thus indirectly the blowing operation and the quality of the steel.

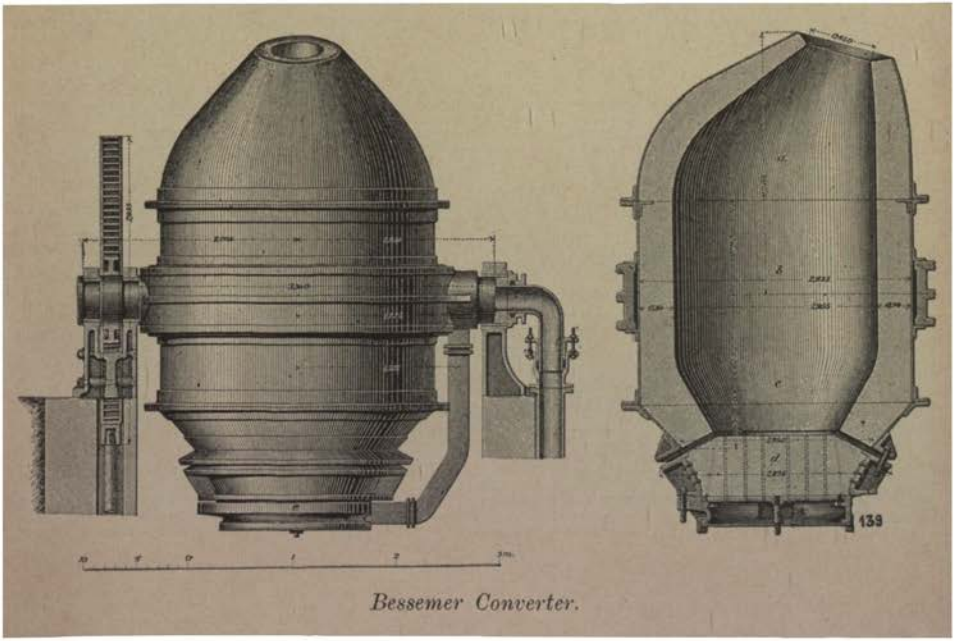
The Basic Bessemer Process. In the Swedish acid process the silicon in the pig iron is the real generator of heat, though quite a respectable additional amount is supplied by the manganese. In the basic process, on the other hand,

the place of the silicon is taken by the phosphorus, the manganese again playing a more subordinate rôle.

The honour of having elaborated a Bessemer process for phosphoriferous pig iron belongs to the Englishmen, *Gilchrist* and *Thomas*, who in 1878 had success with their experiments in this line. The method is in fact called, after the latter, the Thomas process.

The basic Bessemer process was first introduced in Sweden at Bångbro on the 24 May 1880. It was afterwards worked there for a short time every year up to 1890 inclusive, when the method was abandoned, and was not taken up again before the 30 August 1906. At Domnarvet it was employed for the first time in 1891.

Swedish pig iron for the basic Bessemer process contains about 2·5 % of phosphorus, a few tenths percentage of manganese, and a couple of tenths percentage of silicon. It is made from the most phosphoriferous ores of the Grängesberg mines, the fuel being charcoal, or coke, or a mixture of both. The pig iron is taken direct from the blast furnace to the converter.



Bessemer Converter.

The bodies first given off in the process are silicon, manganese and carbon, after which comes the phosphorus. The product is always soft; no recarburizing occurs. In other respects the process is the ordinary Thomas process, as applied in German works, and Thomas slag (Thomas phosphate) is obtained as a by-product.

The basic Bessemer metal made in Sweden is consumed mainly in the home country.

The waste in basic Bessemer is from 14 to 15 %.

The Siemens-Martin Process (Open-hearth Process). This process has received its name from the two brothers *P.* and *E. Martin*, who in 1866 succeeded in making steel in a flame furnace equipped with regenerators (Siemens furnace) at their little works at Sireuil in France.

The process calls for a very high temperature in the furnace, from 1 500° to 1 800° Celcius, according to the carbon-content in the product to be made — to render it possible to tap the metal from the furnace in a molten state. The raw materials are pig iron, steel-scrap and iron ore in varying ratios. By the action of the oxidizing furnace-gases, and secondarily by the action of the slags, the silicon, manganese and carbon, and, in the basic method, also the phosphorus and sulphur are more or less completely removed in the process.

Photo. GEHRMAN, Hedemora.

Converter at Work (Långshyttan.)

The open-hearth method immediately attracted attention in Sweden, and *L. Rinman* went to Sireuil in order to study it on the spot. On Rinman's return to Sweden, the first experiments with the new process were started under his superintendence, and with the financial support of Jernkontoret, at the Munkfors Iron Works: this was in 1868. A regenerative heating furnace which already existed there was transformed into an open-hearth furnace, for the purpose of experiment. In the following year a heating furnace at Hellefors in Södermanland was similarly revamped, and the first real open-hearth furnace in Sweden was constructed at the Kilafors Works in Hälsingland.

However, the process was tardy in its development. The few works who experimented with it employed small furnaces of from 1 to 2 tons

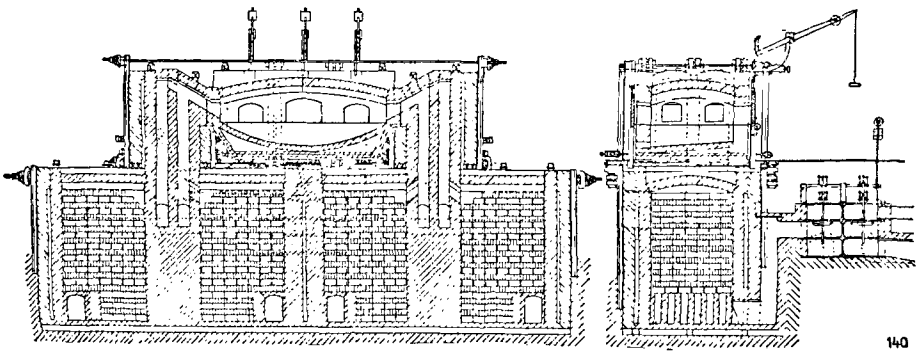
with open regenerators. The fuel used was producer gas made from wood, and condensers were employed to rid the gas of its water.

It was not till the eighties that the process began to win general confidence. Since that time, as will be seen from Table 60, the production of open-hearth steel has developed steadily and at a rapid rate. The greater cheapness of the method, the greater choice with regard to raw materials, the greater certainty with which the carbon content of the final product can be determined and the superior quality of the product for certain purposes explain the rapid encroachment of the open-hearth steel in quarters, where Lancashire iron and Bessemer steel hitherto practically held the field.

The output of open-hearth steel exceeds the output of Bessemer steel from the year 1894 and the output of wrought iron from 1900.

Concurrently with this rapid development, the furnaces were built of larger size — to begin with for from 5 to 10 tons, now for 12, 15, to 20 tons and upwards, — ore began to be used for the refining, the regenerators were made larger and closed, seperate channels and ports for gas and air were arranged and producer gas was used as fuel.

A preceding map shows the situation of the Siemens-Martin furnaces actually running in 1912.



Open Hearth Furnace.

The Acid Open-hearth Process. The acid process, like the acid Bessemer process, demands a raw material practically free from phosphorus and sulphur, for neither of these bodies are removed in the acid furnace. In Sweden both pig iron and scrap with extremely low phosphorus and sulphur contents are used for the acid process.

The ratios between the pig iron and the scrap vary considerably, according to the supply of raw material and the purpose for which the product is intended. The charge may be, for example, 73 % of pig iron + 7 % of scrap + 20 % of ore, or, at the opposite extreme, 26 % of pig iron + 74 % of scrap.

Pig iron for the acid open-hearth process contains as a rule from 0·50 to 0·75 % of silicon. The finery ore should contain as much iron as possible. Ore of this kind often contains from 65 to 70 % of iron.

TABLE 60. *Output of Siemens-Martin Steel in Sweden.*

Annually	Acid tons	Basic tons	Total tons	Annually	Acid tons	Basic tons	Total tons
1876—80 . . .	3 498	—	**3 498**	1901—05 . . .	119 385	113 463	**232 848**
1881—85 . . .	14 077	—	**14 077**	1906—10 . . .	137 417	187 847	**325 264**
1886—90 . . .	·	·	**47 489**	1911	148 322	224 383	**372 705**
1891—95 . . .	·	·	**83 981**	1912	160 418	243 700	**404 118**
1896—00 . . .	113 703	57 418	**171 121**	1913	186 501	282 886	**469 387**

The time occupied by a charge, reckoning from tapping to tapping, varies greatly in different works; usually from 8 to 12 hours.

The consumption per ton of steel is from 350 to 450 kilograms of coal, or about 40 to 50 hectoliters of wood or stumps.

"Alloy steels" *(legerat stål)*, containing e. g. nickel, chromium, manganese, tungsten, are now made in Sweden for certain purposes in acid open-hearth furnaces. Moreover, the Swedish manufacture of castings of acid open-hearth steel has long been famed for its superior quality.

The Basic Open-hearth Process. The basic process is employed in Sweden chiefly for the production of soft material, but in certain places also for the making of high-carbon steel, in the latter case from pure materials. The process was in Sweden first applied at the Jäder Works in 1889; soon afterwards it was adopted on a larger scale at Kallinge.

The advantage of this process is that one can use more phosphoriferous, and thus cheaper, pig iron and scrap than is possible in the acid process, and that the cost of production is lower both for the above reasons and on account of the shorter time taken by the charges (from 6 to 8 hours between the tappings).

Pig iron for the Swedish basic open-hearth process usually contains from 0·3 to 0·5 % of silicon, about the same amount of manganese and not more than 0·1 % of phosphorus.

Crucible Steel. Crucible steel is at present made at Österby, Vikmanshyttan, Söderfors, and Fagersta. For the output of crucible steel see the Table 61.

Steel-making in Electric Furnaces. Since the beginning of the present century endeavours have been made in Sweden to utilize her rich supplies of water power for metallurgical purposes; the aim being partly to diminish the consumption of charcoal, and partly to render oneself less dependent on imported fuel. In the foregoing pages we have indicated,

TABLE 61. *Output of Crucible Steel in Sweden.*

Annually	Tons	Annually	Tons
1891—95	598	1911	1 325
1896—00	931	1912	2 275
1901—05	1 153	1913	2 656
1906—10	3 385		

TABLE 62. *Output of Steel in Electric Furnaces in Sweden.*

Year	Tons	Year	Tons	Year	Tons	Year	Tons
1900 . . .	14	1904 . . .	552	1908 . . .	967	1912 . . .	1 285
1901 . . .	37	1905 . . .	995	1909 . . .	591	1913 . . .	2 276
1902 . . .	208	1906 . . .	935	1910 . . .	431		
1903 . . .	539	1907 . . .	1 116	1911 . . .	2 034		

what measure of success has accrued to these endeavours with respect to the reduction of iron ore.

The development in Sweden of the **production of steel in Electric Furnaces** is shown by the subjoined Table 62.

The pioneer for this industry in Sweden was the Swedish engineer, *F. A. Kjellin,* who in 1900 started at Gysinge a small *induction furnace,* constructed by himself. This little furnace was replaced in the same year by a somewhat larger one and in the following year by a furnace taking 1 800 kilograms and intended for an output of 1 500 tons of steel per annum. It is still running. The electric power available for this larger furnace is 175 kilowatts.

The raw material used is pig iron and wrought iron in varying ratios, according to the carbon content required in the final product. A little carbon and silicon is oxidized in the smelting; but the greater the percentage of pig iron used and the more rusty the material, the larger is the amount of carbon and silicon oxidized. Occasionally the process is carried out in the manner of a real fining process, in which case iron ore or iron ore briquettes are used in the required quantities. The process is then very similar to the open hearth process. In any case samples are taken, and a forging test is made in the usual manner.

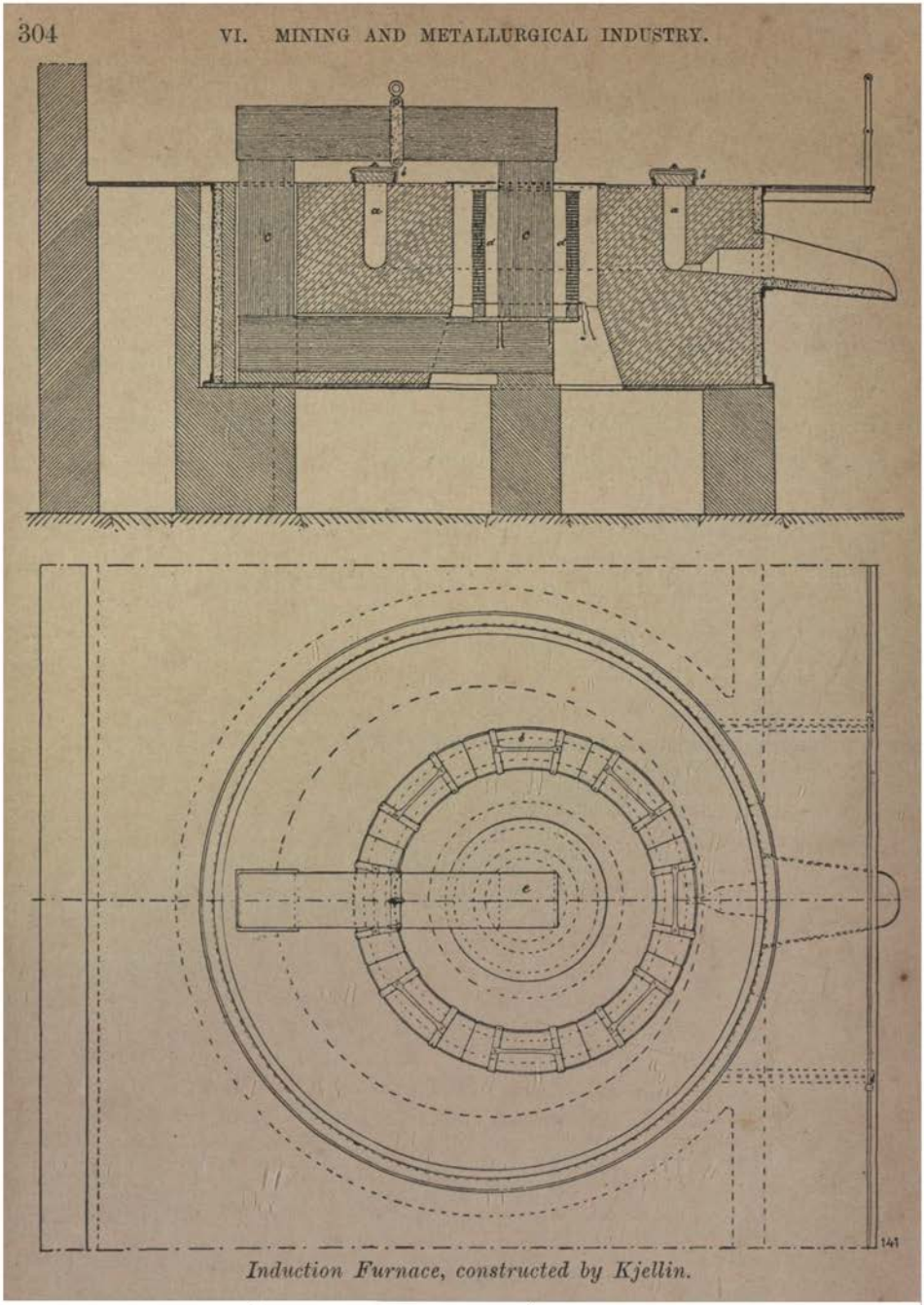
The smelting takes about 4 1/2 to 6 hours. In the tapping about a third of the steel is left in the furnace, in order to serve as a conductor for the current, so that there may be no interruption in the supply of heat. About 1 000 kilograms of steel are tapped in each discharge. The output is thus about 4·5 to 5 tons per day of 24 hours, and 700 to 1 000 kilowatt-hours are consumed in the smelting per ton of steel.

In 1903 was installed at Kortfors an *electric steel furnace* with a capacity of three tons; it is of the type constructed by the Frenchman, *P. Héroult.* The Héroult furnace is an "electrode furnace", that is, the electric current is supplied to the furnace by electrodes of coal or graphite. In 1909 a similar furnace was built at the same spot for charges of 7 tons.

At Ljungby and Héroult-furnace (charge 1 ton) for steel-castings is now being built.

Since 1910 an *electrode furnace* of the *Aktiebolaget Elektrometall* type has been run at Söderfors.

In 1912 was started at the Hallstahammar Bolt Factory a small



Induction Furnace, constructed by Kjellin.

electrode furnace (charge 200 kilograms), constructed by the Swedish engineer *Ivar Rennerfelt*.

At the present moment of writing (October 1914) there are alltogether 9 furnaces of this type installed at different places (Hallstahammar, Ljusne, Svedala, Söderhamn, Trollhättan, Virsbo) in Sweden, the capacity ranging between 200 and 1 000 kilograms.

At Guldsmedshyttan an electric furnace of about the same type as the Rennerfelt-furnace has been running since 1913, producing steel specially for steel-castings.

The Manufacture of Alloys.

The electric manufacture of certain alloys used chiefly in the iron industry has been carried on in Sweden since 1904. For this purpose electrode furnaces of the same type as those used in the carbide industry are employed.

The places where this manufacture exists are Domnarvet, Gullspång, Kortfors, Månsbo, Sandsta (near Hagge), Trollhättan and Vargön (near Vänersborg). At present (February 1913) there are at these places 1, 6, 2, 1, 1, 3, 6 furnaces respectively in work.

The **output** has been as follows (approximate figures):

Year	Ferro-silicon	Manganese-silicon
	Tons	Tons
1904	225	—
1905	230	3
1906	665	—
1907	950	—
1908	1 077	25
1909	2 524	—
1910	4 570	186
1911	4 104	472
1912	5 984	1 028
1913	9 863	1 375

At Månsbo since 1901 about 25 tons of 15 per cent ferro-silicon has been yielded per year as a by-product in the manufacture of calcium carbide.

At the Sandsta furnace, which was started in the middle of August 1912, is manufactured a potashiferous manure (electro-potash), in which ferro-silicon is obtained as a by-product.

The ferro-silicon contains from 12 to 96 %, as a rule about 50 % of silicon, and the manganese-silicon contains from 20 to 30 % of silicon and 70 down to 50 % of manganese.

The manufacture of other alloys, such as manganese iron and chrome iron has also occurred sporadically; at present there is a factory at work at Trollhättan, where the last-named alloy is manufactured in electric furnaces. In 1913 760 tons of chrome iron and 136 tons of silico-manganese-aluminium-iron were produced in Sweden.

During the years from 1885 to 1907 chrome-pig-iron was made at Gothenburg in a furnace of the Wittenström type heated with *masut*.

3. PRODUCTION OF OTHER METALS.

The iron industry now has such a dominant position in Sweden that all other metals are comparatively insignificant. This has not always been the case: during the 16th, 17th, and 18th centuries silver, and still more copper, were of supreme importance for the industry and economy of Sweden. During the greater part of the 17th century Sweden was by far the biggest producer of copper in the world. The maximum output was reached in 1655, namely 3 453 tons: a quantity then sufficient to cover the whole world's consumption of copper. Ever since the 18th century the Swedish mining industry, setting aside iron, has, on the whole, been steadily declining: this will be realized very clearly, if we compare it with the world's production of these other metals. In recent years, however, a noticeable improvement has taken place, mainly due to the invention of electro-metallurgical processes for the manufacture of certain metals. Whether Sweden's metal industry shall one day recover its ascendant position, will depend very much on these electro-metallurgical processes: whether those processes shall be developed to such perfection, that they can advantageously replace the smelting processes hitherto in use. If this is to be, Sweden has, owing to her abundant supply of comparatively cheap water-power, very fair prospects for setting on foot a metal manufacture on a big scale: and this, even if the necessary raw materials should not be found within the country in sufficiently large quantities, and it is necessary, to some extent, to resort to import. The first step in this direction has been taken by the erection five years ago

TABLE 63. *Manufacture of certain Other Metals and Metal Products than Iron.*

Annually	Gold kg	Silver kg	Lead tons	Copper tons	Copper vitriol tons	Zinc tons
1861—65	15	1 129	444	1 731	31	—
1866—70	8	1 185	395	2 003	95	—
1871—75	5	780	53	1 162	137	—
1876—80	6	1 117	72	925	175	—
1881—85	25	1 713	269	771	—	—
1886—90	78	4 254	274	835	304	—
1891—95	94	3 478	636	480	754	—
1896—00	110	2 110	1 519	217	1 308	—
1901—05	65	1 036	735	600	1 185	106
1906—10	17	608	473	2 216	545	328
1911	11	1 289	1 134	3 218	320	2 123
1912	31	962	1 073	3 957	870	3 228
1913	25	1037	1 235	4 215	428	2 115

TABLE 64. *Imports and Exports of certain other unmanufactured or partly unmanufactured Metals than Iron.*

Annually	Gold kg	Silver kg		Lead tons		Copper tons		Zinc tons		Total import balance of metals other than iron
	Import	Import	Export	Import	Export	Import	Export	Import	Export	Million kronor
1861—65 .	56	5 007	10	151	155	196	1 487	365	5	—
1866—70 .	113	8 407	3 083	152	297	268	1 804	298	21	—
1871—75 .	1 639	9 964	6 054	481	137	577	910	658	18	3·2
1876—80 .	1 492	1 002	1 729	593	79	768	694	959	57	3·7
1881—85 .	659	426	1	645	253	1 084	755	1 664	21	2·6
1886—90 .	985	876	168	910	187	1 233	662	1 765	52	4·6
1891—95 .	386	2 659	2 849	1 515	709	3 281	537	1 952	86	4·5
1896—00 .	1 849	12 779	388	2 055	1 046	5 021	1 155	2 708	162	11·5
1901—05 .	564	9 553	180	2 863	575	6 453	1 733	3 387	228	13·1
1906—10 .	623	16 760	325	3 106	480	8 585	2 446	5 108	862	17·2
1911 . . .	366	11 230	1 090	2 146	1 177	5 497	575	5 916	2 158	19·0
1912 . . .	320	16 833	2 021	2 309	995	6 807	1 586	6 912	3 135	16·0
1913 . . .	2 104	20 550	4 299	2 676	726	9 560	1 401	6 018	6 531	17 7

of an establishment for the manufacture of zinc by electricity (see Electrochemical Industry).

Table 63 furnishes a bird's eye view of the annual output in Sweden of gold, silver, lead, copper, and zinc since 1861. In Table 64 is given the yearly import and export of these metals during that period, and also the value of the total balance of import for all metals except iron. It will be apparent from the Table that this balance is rapidly increasing, notwithstanding that the output of metal has considerably augmented during the last few years.

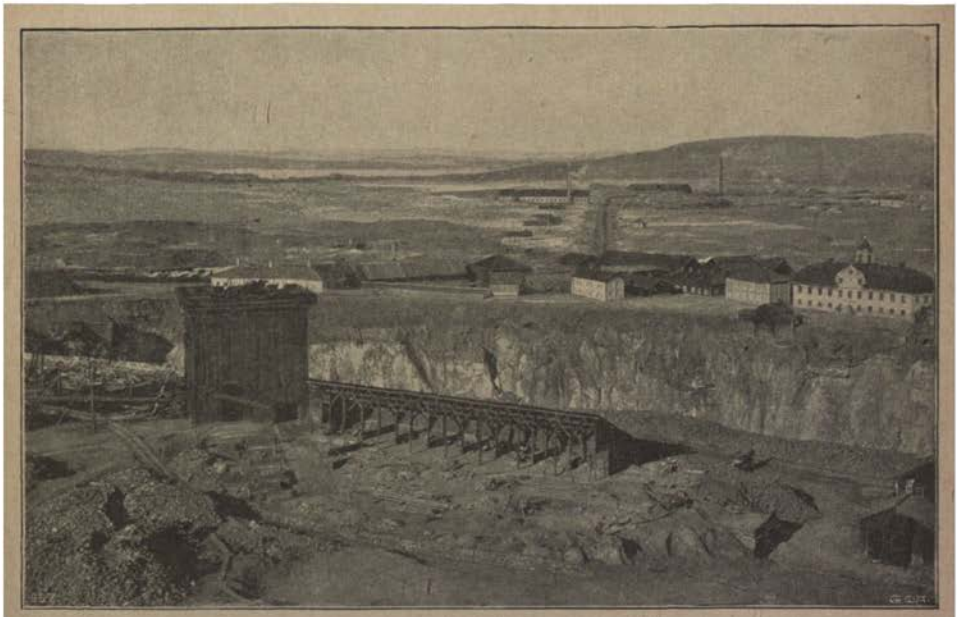
Table 65 displays the annual mining of other ores than iron ore since 1871.

TABLE 65. *Mining of Other Ores than Iron Ores.*

Annually	Silver and lead ore tons	Copper ore tons	Nickel ore tons	Zinc ore tons	Manganese ore tons	Iron pyrites tons
1871—75	10 949	44 274	5 026	30 539	488	2 123
1876—80	11 002	28 055	2 802	40 712	718	1 144
1881—85	14 045	25 276	1 289	45 779	3 426	1 481
1886—90	14 754	20 266	495	53 402	8 977	1 319
1891—95	16 552	23 941	97	48 315	6 090	853
1896—00	8 644	25 590	—	57 701	2 487	448
1901—05	9 424	33 306	—	54 972	2 331	6 103
1906—10	2 081	15 217	—	47 345	4 519	22 012
1911	2 999	1 623	—	51 242	5 377	30 096
1912	2 877	3 059	—	50 036	5 101	31 835
1913	3 222	5 458	—	50 752	4 001	34 319

At the present time Sweden produces, except iron, no other metals but copper, gold, silver, lead, and zinc.

Copper. The amount of copper ore at present mined in Sweden is very small, as is manifest from Table 65, and the ore, which is obtained almost exclusively from the Falun Mine, is not worked into metallic copper, but into copper vitriol. On the other hand, metallic copper has since 1886 been manufactured from imported copper ore (cupriferous pyrites with about 3 % of copper), mainly from Norway.



The Falun Copper Mine.

In former times the copper industry in Sweden was carried on in a large number of small works, mostly situated in the immediate vicinity of the mines; these small works were in the course of time amalgamated into a few large ones, but this was not till the eighties of the last century. They were shut down one after the other, particularly in the seventies, copper having then greatly fallen in price. Thus, in the middle of the eighties only three copper works were being run, namely those at Falun, Åtvidaberg, and Kaveltorp: the two latter have now likewise been shut down. On the other hand, works have been established since the eighties at Hälsingborg, Näverberg, Nautaunen, and Garpenberg: at present only the first-named of these is being run.

The Falun Copper Works. The Falun Mine is certainly the oldest copper mine in Sweden. It began to be worked in the 13th century at latest, and since that time it has been run almost continuously right down to the present day. It is true that the output of copper ore is now very slight: on the other hand, iron pyrites is mined there pretty extensively. This mine, which during the whole of the seventeenth century was by far the most important copper mine in the world, is computed to have yielded in the course of its long existence from 35 to 40 millions tons of ore, out of which have been extracted about 500 000 tons of copper, representing a value of about a milliard of kronor. The

ore consists of copper pyrites, mixed either with iron pyrites (soft ore), or with quartz (hard ore), and contains about 2 to 3 % of copper. In the seventies of the last century gold was also discovered in the ore, and afterwards extracted. From the earliest times right down to the beginning of the seventies of the last century, copper was smelted in shaft furnaces by the so-called Swedo-German process. Afterwards, owing to the higher price of fuel and the diminishing amount of copper in the ore, the Henderson extraction process was introduced, and in 1904 the smelting process has again been reverted to.

Since 1894 all the ore mined is worked up into vitriol, and no commercial copper has been manufactured.

. *The Hälsingborg Copper Works.* The Hälsingborg Sulphuric Acid and Superphosphate Factory began in the eighties to work up into copper the burnt pyrites obtained in the manufacture of sulphuric acid. In 1902 was erected a separate copper works in the vicinity of Hälsingborg, and now more than 85 000 tons of burnt pyrites are being annually worked up into copper (from the *Sulitelma* mines).

Copper is obtained from those burnt pyrites as "blister copper" by the Henderson wet extraction process and is refined to "best selected" quality.

The output of the works for 1913 amounted to: 4 215 tons of refined copper obtained from blister and crude copper from the locality, 1 206 tons of refined copper obtained from crude copper from Sulitelma, and 64 345 tons of briquettes, representing altogether a value of more than 6 million kronor. The number of hands is about 350.

Although the output of copper in Sweden has increased considerably during the last few years, it is far from being able to cope with the demand, as will be apparent from Table 64.

Silver and Lead. The production of silver and lead is now of comparatively slight importance. In 1911, when the output was far larger than in the years immediately preceding, only 1 289 kilograms of silver, and 1 134 tons of lead were manufactured. The manufacture of lead has never been of any consequence in Sweden, and lead has mostly been obtained as a by-product in the manufacture of silver. The latter, however, was in former times, that is, during the 15th, 16th, and 17th centuries, of great economical importance for Sweden.

Silver is now produced only at the Sala Silver Works, and in very small quantities as a by-product at the Hälsingborg and the Falun Copper Works. Lead is obtained at Sala, and also at the Trollhättan Zinc Works as a by-product in the smelting of plumbiferous zinc ore. Two smaller lead works — at Kallmora and Kaveltorp — have been abandoned since the beginning of the nineties.

The Sala Silver Mines. In the 14th and 15th centuries Sweden's requirements of silver were supplied from the Östra and Västra Silfberget Mines; in the 16th century this role was assumed by the Sala Silver Mine, which since that time has been the only silver mine of any importance in the country. Its history dates back to the end of the 15th century, but it cannot be determined with certainty whether any mining of silver had taken place there prior to that time. The Sala Mine has for centuries been endowed by the State with privileges: grants of land and forests, and licenses to obtain timber and charcoal from the neighbouring parishes. In return the State reserved to itself the right to manage the mines, and claimed a payment in kind (avrad), consisting of 10 % of the silver produced. This state of things continued till 1890, when the mine and the works were purchased by a private company.

The output of silver attained its maximum during the reign of Gustavus Vasa, when it was about 3 000 kilograms per annum: since then it has been steadily declining. This decline is due to the increasing dearth of the ore: for about ten years neither silver nor lead have been extracted from the mine itself. The

ore which is now worked is obtained from the old heaps of gangue, and from other mines in the country. The ore is smelted in shaft furnaces for lead, from which the silver is then separated by zinc, and is then precipitated by electrolysis.

With regard to the production of silver, Sweden possesses data ranging over a longer succession of time than any other country: right away from 1400 down to the present day, with the exception of two short periods. The output during the different periods was as follows.

Year	kg	Year	kg	Year	kg	Year	kg
1400—93	61 591	1701—00	36 508	1846—50	6 271	1911	1 289
1506—43	52 881	1801—20	7 894	1851—55	6 329	1912	962
1544—51	22 718	1821—30	5 621	1856—60	5 548	1913	1 037
1560—00	19 432	1831—40	8 095	1861—00	79 014		
1601—00	60 728	1841—45	4 749	1901—10	4 074	Total[1]	**384 786**

Adding the years for which statements are lacking, the entire output of silver for the last five centuries is computed at about 400 000 kilograms, by far the greater part falling to the Sala Mine.

Gold. Gold is obtained in Sweden only from the Falun Copper Mine, and now in very small quantities. Gold was not discovered in the ore till 1881, although it had been ascertained in the sixties that the copper obtained from the ore was auriferous. Gold occurs in well-formed quartz veins together with bismuth, and in varying quantities: from a couple of grams to several hundred grams per ton of ore.

As long as the Henderson extraction process was used for the working of the ore, the gold was released by treatment with chlorine by the Plattner-Munktell process. Now that the smelting process has been reverted to, the gold is obtained together with the silver in the refined copper. The total amount of gold obtained from the Falun Mine aggregates about 2 tons, representing a value of approximately 5 million kronor.

Besides the Falun Mine, there has existed only one real gold mine in Sweden, namely Ädelfors. This mine, which was discovered in 1738, was worked till 1822, but on a very small scale, and with very poor results.

Nickel. Nickel was formerly produced at two works in Sweden, notably Kleva and Sågmyra. When, in the eighties of the last century, the biggest known nickel deposit in the world was discovered — at Sudbury in Canada — and the price of nickel sank to nearly half, these two works had to be shut down, and since that time no nickel has been manufactured in Sweden. Besides the nickel ores at Kleva and Sågmyra, there are several other ore deposits, e. g. at Frustuna, Haddbo, Ruda. The ore in all the mines consists of magnetic pyrites; however, the supplies are in most cases comparatively insignificant, and the percentage of nickel is so low, that prospects for a remunerative production of nickel are almost nil with the metal at its present price.

Zinc. Sweden possesses pretty considerable supplies of zinc: they consist exclusively of zinc blende. In 1913 were obtained 50 752 tons of ore, making about 3 % of the world's production, and representing a value of about 2 100 000 kronor. The bulk of the ore mined is obtained from the Ämmeberg mines, belonging to the Belgian company Vieille Montagne, and the rest from Ryllshyttefältet, Kaveltorpsfältet, Saxbergsfältet, Stollbergsgruvan, and the Dannemora mines.

Notwithstanding the rich supplies of zinc ore, there has been no manufacture of zinc in Sweden in recent years. The chief reason is that the usual, and

[1] Data are lacking for the periods from 1494 to 1505 and 1552 to 1559. It is also to be observed that the periods do not include equal number of years.

until latterly the sole process employed for the manufacture of zinc demanded a great consumption of fuel, and Sweden is deficient in cheap fuel for this purpose. Now, however, electric smelting furnaces have been successfully used for the manufacture of zinc: in these furnaces the fuel is to a great extent replaced by electric energy. This process, originally proposed by the swede de Laval, has been adopted at the zinc works erected five years ago at Trollhättan, the only zinc works that now exist in Sweden. For an account of these works the reader is referred to the section: The Electrochemical Industry.

4. MEASURES FOR THE PROMOTION OF MINING.

Administration of Mining. Matters relating to Mining were formerly managed by the *Bergskollegium* or Board of Mines, instituted in 1630. In 1858, this office was abolished and its business transferred to the **Kommerskollegium** or **Board of Trade** (until 1900 under the Home Department, but now under the Finance Department). After reorganization in 1891, one of the three bureaus into which the Board was divided was reserved for mining matters as well as industry in general. With reference to the *Office of Mine Maps*, which is under the same bureau, see p. 262 **Mining statistics** since 1858 have been compiled by the Board of Trade; the statistical methods have recently been reorganized, and yielded results of far greater value and reliability.

Jernkontoret (Iron Institute) or the Society of Ironmasters is an institution peculiar to Sweden; its mission is to give financial support and encouragement to the Swedish iron industry.

The actual founder of the "Jernkontoret" was *A. Nordencrantz*. The Society founded by Royal charter of the 29th Dec. 1747, commenced its work in 1748. At first it was under the supervision by the Secret Committee of the Riksdag, but since 1769, it has possessed complete independence. The present regulations date from the 26th Jan. 1894, with minor amendments of the 26th July 1901.

Most of the Swedish Iron works are part-owners in the "Jernkontoret", where they have a vote; they pay annual contributions to the funds, amounting to about 0·59 kronor per ton of originally registered iron. The Board consists of 10 members of which 5 form an executive committee. Each member is appointed for three years at the general meeting of the Society, generally known as the »*Jernkontorsriksdag*» or "Iron Parliament".

The main object of the "Jernkontoret" is to assist the members with loans on favourable conditions. Especially during the first period of its existence, the "Jernkontoret" sent considerable sums of money down to the big iron market at Kristinehamn; and in times of depression the "Jernkontoret" itself purchased iron from iron manufacturers, with the express purpose of keeping prices at a "fair and equable level". It now restricts itself mainly to advancing working capital, and making other loans for special purposes (e. g. for building loans, etc.).

But, as has been said, the "Jernkontoret" has another important mission, namely the scientific and technical improvement of the Swedish iron industry.

For this purpose the "Jernkontoret" annually grants considerable sums for

research and experiment to mining colleges, training courses for charcoal-burners, testing institutes at home and abroad, geological surveys, and so forth; it employs a body of technical advisers to assist its members, awards travelling bursaries to engineers and workmen, financially supports the publication of scientific periodicals and treatises, and the representation of the Swedish iron industry at domestic and foreign exhibitions. Since 1817 the "Jernkontoret" has published a periodical of its own, "Jernkontorets annaler", the very oldest metallurgical periodical in the world.

The "Jernkontoret" has received no support from the State, except during the first period of its existence, when its members obtained the right of raising money in the Bank of Sweden on publicly weighed iron; this right was afterwards commuted for a credit at the bank for 900 000 kronor at 4 % interest (from 1818 to 1870). With a minor exception, the members have received no dividend.

At the close of 1912, the "Jernkontoret" possessed, in round figures, a Working Capital of 4 million kronor, a Reserve Fund of 2 million kronor, and a General Fund of 1 300 000 kronor, the totals assets aggregating over 7 million kronor.

It is also to be noted here that a number of **associations** are founded for the promotion of the mining industry, e. g. the "Järnverksföreningen", the "Bergshandteringens vänner", and others.

Instruction in Mining is imparted at the Tekniska högskolan[1] (Royal Technical High School) at Stockholm (which includes a special department for mining commonly known as "Bergshögskolan"), and at the Mining schools at Filipstad and Falun.

At Falun a School of Mines was established as early as 1822; it was primarily intended for imparting instruction in mining to university graduates. In 1868 the school was incorporated in the Stockholm Royal Technical High School, of which, as mentioned above, it constitutes a separate department under its own director. The "Jernkontoret" has granted an annual subsidy of 15 000 kronor for the practical training of the students under experienced teachers.

The course for mining and metallurgical engineers at the "Bergshögskolan"[1] ranges over 4 years; and is distributed over three lines of study: mining, metallurgy and mechanics. The conditions for admission are the same as those for other departments of the Royal Technical High School.

The (lower) Mining School at *Falun* was formed after the former School of Mines had been removed to Stockholm (see above). The (lower) School at *Filipstad* was established in 1830. These schools are supported by the "Jernkontoret", the State also contributing to their maintenance,

Both these Schools are intended for the training of superintendents and clerks in iron works, as well as of foremen and overseers of mines. The course lasts one year, and comprises the elements of metallurgy, assaying, mining and mechanics, along with the theoretical subjects on which these sciences are based. In each of the schools there are three regular instructors. One of the conditions for admission, is lengthy practical experience in the branch previous to entering the school.

[1] A *högskola* has in Sweden the rank of a university.

VII.

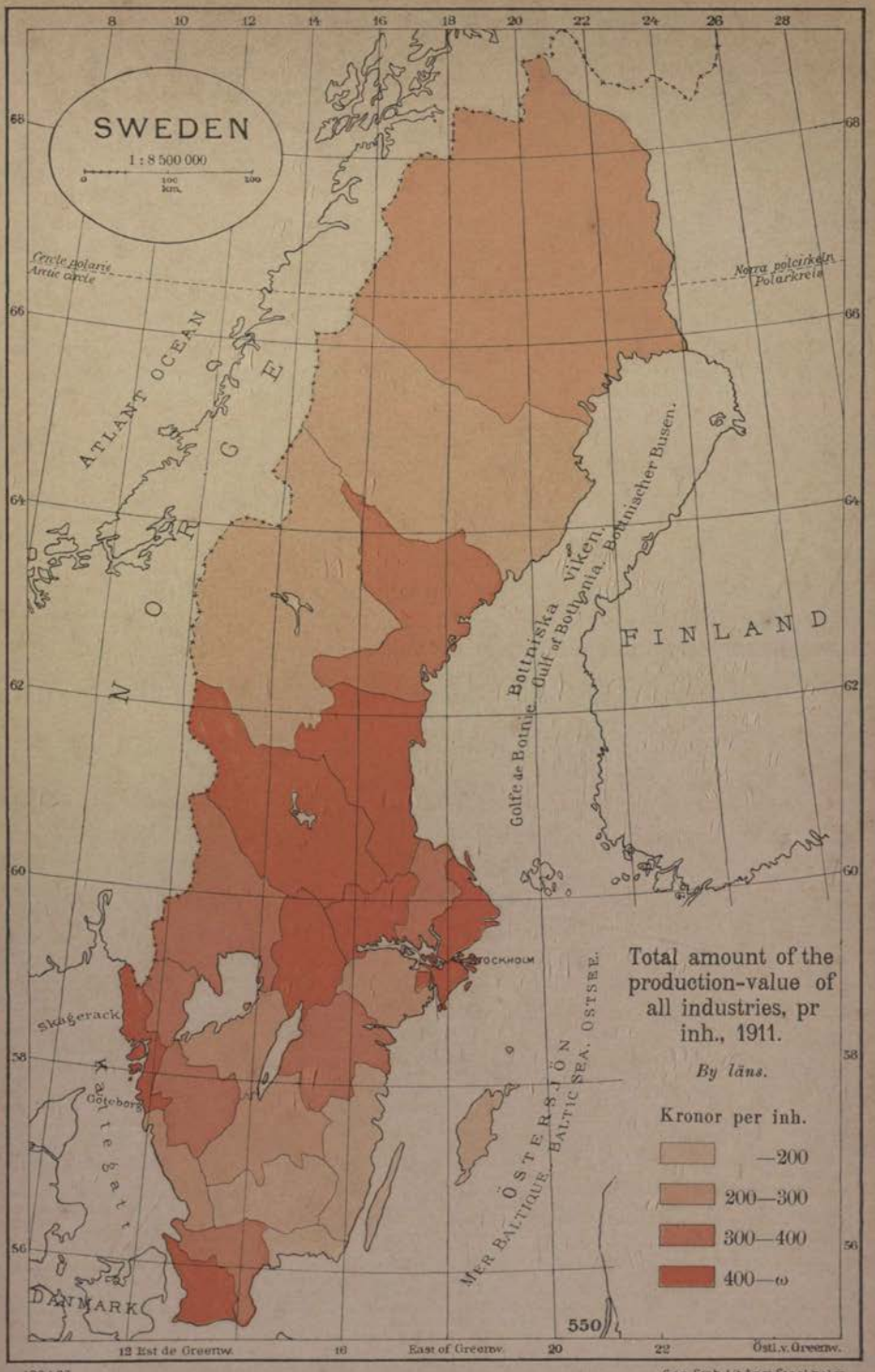
MANUFACTURING INDUSTRIES.

In accordance with Swedish statistical praxis. all the branches of industrial life which have not already been dealt with are here. inclusive of handicrafts and domestic industries, brought together under the title of *manufacturing industries.* Dairy-farming and the saw-mill industry, as well as mining and the crude metal industries are thus excluded, as they are treated of separately in chapters 6, 7 and 9 respectively.

As we have already had an opportunity of pointing out, mining was the industry, which was the first to attain to any considerable degree of development in Sweden. Apart from this branch, it must be allowed that the manufacturing industries which are carried on at all extensively in Sweden are of comparatively late date.

In the Middle Ages and for some considerable time later, the industrial life of Sweden may be said to have been exclusively domestic in character; hence, the review given below of the history of handicrafts embraces at the same time the story of the first beginnings of industry in the country in past times. First in the **sixteenth century** can the beginning of the great industries, in the modern sense of the word, be traced in Sweden; here, as in almost all other fields, the leaders and promoters were the two Kings, Gustavus Vasa and Charles IX. *Gustavus Vasa* (1523—60) was the great regenerator of the country, first and foremost by re-establishing the independence of Sweden and by securing for her a firm political organization; at the same time he was himself, as a farmer, as a manufacturer and a man of business, the largest employer in his kingdom. Sweden had already at that date attained a fairly high position in shipbuilding and in the manufacture of arms. *Charles IX* (1599—1611) did great service to industry in his time. In the compass of his duchy, many factories were set up, such as for cloths, arms, and glass; there too, a very considerable manufacture of tar was carried on, an article which at that time, and for long afterwards, formed one of the chief articles of exports from Sweden.

The industrial history of the **seventeenth century** is also closely and primarily connected with the names of the great statesmen of the time, viz. the two Kings Gustavus Adolphus and Charles XI, and the famous Chancellor of the former monarch — Axel Oxenstierna. The name of a private individual, is here met with for the first time, that of Louis De Geer. The contributions of *Gustavus Adolphus*



123483 Gen. Stab. Lit. Anst. Stockholm

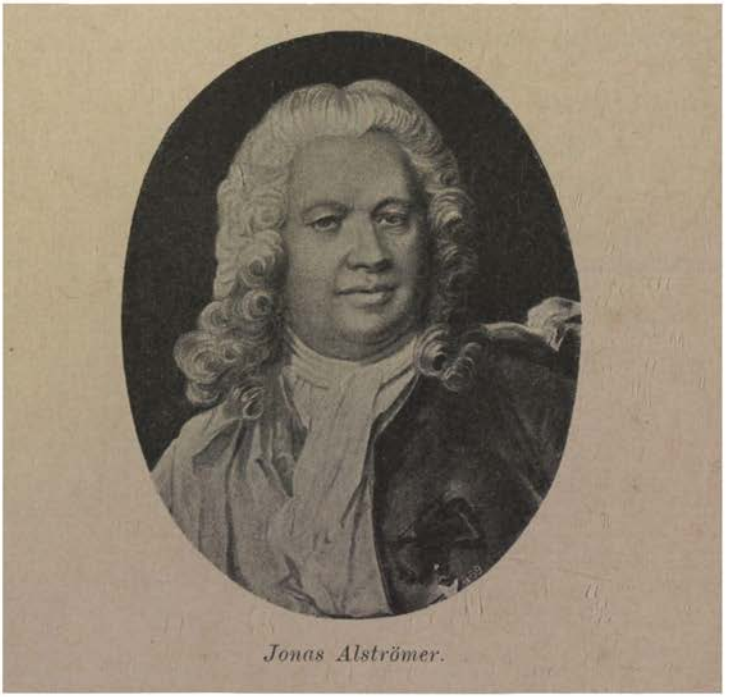
(1611—32) and *Axel Oxenstierna* to the industrial life of their age were chiefly in the fields of trade and navigation, but they also made great efforts to stimulate and promote manufactures. In this department, by far the greater part had to be created afresh. Skilled workmen were called in from abroad to instruct the Swedish artisans, who, as a class, have never forgotten what they then acquired; and, to remedy the lack of capital in the country, competent and wealthy business men were induced by various means to settle in Sweden and invest money in industrial enterprises. The most eminent of these foreigners was *Louis De Geer* (1587—1652), a Dutchman, who, after having already embarked largely in business on Sweden at an early period of his life, settled in the country in 1627. As a naturalized Swedish subject, he served his new country well and faithfully, while, in return, it threw open to him its manifold natural resourses, granting him very extensive privileges and thereby rendering his opportunities and consequent gains greater. Every circumstance gives evidence of a remarkable policy, pursued with great consistency by Gustavus Adolphus and Oxenstierna, of discovering men of the greatest capacity in every domain, and endeavouring to attract them to the country for the benefit of Sweden — a broad and enlightened patriotism that has had the most beneficent results. Louis De Geer did a great deal at Dannemora, but, above all, he transformed Finspang into the chief seat of manufacturing industry in Sweden, erecting blast-furnaces, tilthammers and factories there, improving the forges on the French or Walloon pattern, and erecting gun-founderies, etc. Norrköping became the port from which were shipped the products of this increased activity and it grew so rapidly as from that time to rank with the chief towns of Sweden, although, until then, it had been a very inconsiderable place. In Norrköping itself, industrial establishments, too, were founded; rifle-factories and a brass-foundry; the manufacture of cloth, that has since been a noted production of the town, dates its origin from that period. (The first cloth factory in Sweden of any importance had been established at Jönköping about 1616.) The linen industry and leather manufacture attained a considerable development; breweries were started on the model of those in Germany and England, and paper-works were established; the production of arms continued to flourish; the famous copper-mine in Falun attained at this time its maximum output, while the Eskilstuna-ware, in our days so renowned, began to be manufactured in the reign of Charles X Gustavus (1654—60).

Charles XI (1660—97), whose energetic influence covered a very wide field, paid attention to industry, too. Cloth-manufacture, in particular, developed with rapid strides, largely owing to the King's orders that the uniforms then introduced into the army should by exclusively made of home manufactured material. The production of arms was further developed and great quantities were manufactured, not only in the larger factories, but also by artisans and in the homes. Swedish shipbuilding, an ancient industry, made important progress, and at Söderfors there was erected an anchor-forge which soon became famous throughout Europe.

To sum up, then, the Swedish industries of the seventeenth century were by no means insignificant. They may be said, however, to have been confined to a few branches only and were far from being able to satisfy the needs of the country. It was the chief object of the **eighteenth century** to extend manufacturing industry to all departments in order to diminish, as for as possible, the import of manufactured articles: altered political conditions caused the rôle of promoter to pass to the representatives of the people in the *Riksdag*, and to *private individuals*. Among the latter, the foremost place now belongs, no longer to a foreigner but to a Swede, *Jonas Alströmer*. This remarkable man was born at Alingsås in 1685. He began his career as a merchant in

London. It was not long, however, before he conceived it to be his life's work to make his native land a participant in the flourishing industry that formed the basis of the wealth of England, and he laboured incessantly during the remainder of his life to accomplish this end, displaying those qualities of strength of will, unselfishness, and unpretentiousness, that are often to be met with in Swedes when a man has found an object in life to which to devote his entire energy.

Alströmer began this project by sending over to Sweden workmen and machinery for the weaving of woollen and cotton goods, but he soon determined to move to Sweden himself. In Alingsås he erected all kinds of factories for textile goods, and, under his guiding hand, Alingsås became the chief seat of this species of industry, and engineers, artisans, and foremen came in large numbers to study the methods in use there. One of the leading principles that Alströmer held, was, as far as possible, to make use of Swedish raw materials. He was, therefore, specially active in furthering an improved sheep-breeding, the culture of dyeing-plants, tobacco etc.



Jonas Alströmer.

In his efforts Alströmer enjoyed generous support and encouragement from the Government and the Riksdag. The mercantile system — at that time already losing ground in most other countries — now first began to flourish in Sweden in form of an extremely comprehensive system of subventions and protection. Beside the textile industry, which was chief favourite at that time, and attained a not insignificant development, although, as far as concerns quality and cheapness, it could only with difficulty compete with that of other countries, a great number of other industrial branches were begun which were also liberally supported by grants and protected by high duties or by import-prohibitions for foreign manufactured articles.

It is, however, a deplorable truth, that much of the youthful enthusiasm which had been so promising in the beginning, died away unproductively. Clever

mercantile ideas that were pursued in Sweden with the utmost consistency, gave rise to many industrial enterprises not adapted to the conditions of the country; it was subsequently found that they had been doomed to failure from their very inception. The end of the decade 1751—60 was, most probably, the summit of the development just mentioned; in the next decade a crisis occurred, that swept away many of the creations artificially brought into being, and entailed ruinous effects on different parts of the Swedish industrial life of the period. But, though the edifice built up by Alströmer and his helpers and supporters. partly broke down, one element of their work was *not* lost, viz., the industrial *education* which they imparted to their countrymen, for that is, in a great measure, owing the economic progress that has come about in later times.

The reign of *Gustavus III* (1771—92) was of import for Swedish industry up to a certain point, in so far that a more liberally-minded legislation contributed its quota towards placing industrial enterprises on a sounder basis. The credit of this improvement belongs principally to the great financier *J. Liljencrantz* (1730—1815). Generally speaking, this period, though poorer in initiative, was on the whole characterized by a quiet progressive development.

With the dawn of the **nineteenth century** came the vast revolution in the industrial world entailed by the discovery of steam as a motive power. Sweden appropriated the epoch-making discovery at a very early date, a circumstance due to the efforts of *A. N. Edelcrantz* (1754—1821), a very versatile official, scientist, and literary man. He went to England in 1804, returning with four steam-engines of the best construction, on Watt's system. To set up these engines he procured the services of an English engineer, *Samuel Owen* (1774—1854), a man who earned the gratitude of Sweden for what he has done in many branches of work. The mechanical workshops that Owen established (1809), at Kungsholmen, Stockholm, mark the beginnings of mechanical industry in Sweden. The series of eminent foreigners who have worked as pioneers to promote the industries of Sweden is headed by De Geer and closed by Owen. It was Owen's merit that Sweden came second only to England among the nations in applying steam-power in the service of navigation.

From this time forward, the history of Swedish industry becomes one of the several special branches into which activity in this direction resolved itself; many of the more important features of each will be briefly touched upon in the following pages. The most important events in the general history of legislation on the subject during the nineteenth century are the emancipation of industry from antiquated restraints in the years 1846 and 1864, the French commercial treaty of 1865, whereby the system of free trade was introduced, and the subsequent return to a modified system of protective duties in the years 1888 and 1892.

The number of people gaining their livelihood from industries of all kinds, including handicrafts, was estimated in 1870 at 613 000, i. e. 14·7% of the whole population; the number in 1910 had risen to 1 831 000, or 32·2 % of the whole population. Agriculture, on the other hand, which, in the first named year, gave employment to 71·9 % of the population, was pursued in 1910 by only 48·2 %.

The development of Swedish manufacturing industries during the **last ew decades** may be roughly given by actual figures, though those for the earlier periods are not very reliable. It is not, indeed, until 1896 that the statistics on this point can be fairly trusted. It must be noted, that, from the year mentioned, the figures are not only more exact but also include a greater number of industries — amongst others, chiefly the

TABLE 66. *Development of Manufacturing Industries of Sweden.*

Annually (Statistics altered from 1896)	Number of factories	Number of hands	Value of manufactures in kronor
1861—65	2 465	30 016	71 693 000
1866—70	2 235	31 601	82 966 000
1871—75	2 516	52 207	143 912 000
1876—80	2 827	57 423	154 587 000
1881—85	2 916	68 627	185 643 000
1886—90	3 174	84 482	219 960 000
1891—95	4 165	117 207	316 100 000
1896—00	9 745	238 181	871 708 000
1901—05	11 476	271 096	1 116 038 000
1906—10	11 492	297 118	1 463 073 000
1910	11 435	302 157	1 603 176 000
1911	11 692	304 586	1 651 057 000
1912	11 787	310 437	1 778 373 000

important flour- and saw-mill industries; — while the method of accounts as regards the value of semi-products obtained has been changed. The figures for the years 1861—95 and those for the years 1896—1912 ought therefore to be considered separately and may not be compared with each other.

Another proof of the advance made by Swedish industries is afforded by Table 67, which shows the annual **consumption of coal and coke.**

Thus, in fifty years the consumption of coal and coke has risen from 370 000 tons to 4 640 000 tons annually, or from less than 100 kg to more than 865 kg per inhabitant. The increase during the last ten years has been extraordinarily great.

For Europe as a whole in our days, the consumption of coal per head of the population is about 1 500 kilograms annually. The fact that the figures for Sweden are still so low is the result, in a great measure, of other kinds of fuel being employed on a larger scale than is usually the case elsewhere. For example;

TABLE 67. *Consumption of Coal and Coke.*

Annually	Production tons	Import tons	Consumption tons	Consumption per inh. kg
1861—65	31 000	335 000	366 000	92
1866—70	40 000	378 000	418 000	100
1871—75	50 000	595 000	645 000	151
1876—80	93 000	782 000	875 000	194
1881—85	151 000	1 042 000	1 193 000	259
1886—90	177 000	1 322 000	1 499 000	316
1891—95	203 000	1 759 000	1 962 000	406
1896—00	236 000	2 614 000	2 850 000	566
1901—05	308 000	3 206 000	3 514 000	674
1906—10	291 000	4 349 000	4 640 000	865
1910	303 000	4 453 000	4 756 000	861
1911	312 000	4 288 000	4 600 000	827
1912	360 000	4 774 000	5 133 000	916

the iron industry of the country employs, as is well known, hardly anything but charcoal as fuel, and in many other instances, especially for household use, wood is employed, where, in other countries, coal or other fossil fuel would be used. In addition to this, we have the great number of water-power plants in Sweden, which, in some degree, render the use of coal unnecessary. Water-power in 1912 formed 55 % of the total motive-power employed for the *whole* of Swedish industries, inclusive of mining.

A complete survey of the present state of all the manufactures of Sweden for the last few years may be obtained by consulting the factory statistics. Including the saw-mill- and mining industries, which have been dealt with separately above, the total number of industrial concerns and of hands employed in them, together with the value of the manufactured articles — handicrafts and domestic trades, as well as the building industry and dairy-farming, excluded — amounted to the figures shown by Table 68.

As regards the value of the output it should be noticed that products which are subject to several processes during the course of manufacture are estimated in each case at their full value, this, of course, making the total for all the groups too high. At the present moment it is impossible to decide how much ought to be deducted in order to obtain the exact values.

The statistics shows for 1912 a total value of output of 2 061 million kronor, i. e., 369 kronor, on an average, for each inhabitant in Sweden. It may be seen from the accompanying map how this relation between value of output of manufactures and population varies in different parts of the kingdom. The foremost place is occupied by Malmöhus Län, with a value of industrial output amounting to 614 kronor per inhab., while Jämtland

TABLE 68. *View of Swedish Industries in 1912.*[1]

Branch of industry	Number of factories [2]	Number of hands	Value of output kronor
Articles of food and consumption	3 340	33 706	476 142 000
Textile and clothing industry	730	43 607	221 590 000
Hides, skins and hair	372	10 258	76 350 000
Oils, tar, rubber, etc.	232	3 692	41 771 000
Timber (raw and manufactured)	2 198	71 789	353 087 000
Paper and paper-goods	244	13 050	77 936 000
Manuf. from various vegetable substances	31	731	2 664 000
Manuf. of stone, clay, charcoal, and peat	1 661	48 365	104 538 000
Chemical industry	306	3 869	43 175 000
Ores (mines)[3]	389	14 658	61 781 000
Iron, steel and other metals	152	17 263	220 639 000
Metal goods, ships, etc.	1 859	69 441	321 470 000
Other branches[4]	814	11 929	59 650 000
Total	**12 328**	**342 358**	**2 060 793 000**

[1] While including the mining industry, these figures are far more comprehensive than those given on Table 66, and are, consequently, not comparable with those last mentioned. — [2] Factories that carry on the manufacture of several articles of different classes are included in the table under each of these classes, so that the total number of factories is much too large. — [3] Inclusive of coal, clay, other ores and minerals. — [4] Chiefly graphical industries and electric power-works.

comes last with only 84 kronor. — Table 69 shows, too, the special branches of manufacturing industry that have attained the greatest scope in Sweden.

Sweden may be roughly divided into **three industrial spheres.** The *southern* section of the country, extending northwards to about the latitude of the north shores of the great lakes, is chiefly devoted to agriculture; in addition, however, a very considerable industry is carried on in branches allied to agriculture, and in others also. In *central* Sweden, besides agri-

TABLE 69. *The Scope of Industries in the various Läns in 1912 and a Schedule of the Output-Value of the principal Classes of Industries.*

Län	Factories	Hands	Value of manufac. Mill. kr	D:o per inhab. Kronor
Stockholm (city)	774	29 048	178·86	513
Stockholm län	454	13 729	100·30	420
Uppsala	306	7 292	39·86	307
Södermanland	445	10 465	45·76	254
Östergötland	775	19 895	116·00	391
Jönköping	641	14 121	56·88	264
Kronoberg	325	6 134	21·17	134
Kalmar	475	9 021	45·76	200
Gottland	72	1 154	5·19	94
Blekinge	356	8 434	29·75	198
Kristianstad	557	8 730	73·27	318
Malmöhus	1 200	35 144	284·20	614
Halland	257	5 086	34·45	234
Göteborg och Bohus	761	33 756	194·67	501
Älvsborg	586	20 211	102·34	353
Skaraborg	511	8 728	38·58	160
Värmland	568	15 434	91·58	352
Örebro	614	16 841	97·70	467
Västmanland	477	12 819	81·77	518
Kopparberg	591	17 201	116·17	491
Gävleborg	668	18 805	124·26	486
Västernorrland	425	16 429	99·18	390
Jämtland	152	2 260	10·07	84
Västerbotten	153	4 216	23·07	141
Norrbotten	185	7 405	49·95	303
Total	**12 328**	**342 358**	**2 060·79**	**369**

Rem. The specification embraces industries the total value of whose output is at least 15 mill. kronor annually. As to the valuation, see the text, above, and note 1 below.

Important industries Total for whole kingdom	Value of output Mill. kr
Saw-mills and planing mills	174·14
Flour and grain mills	118·19
Wood-pulp factories	115·73
Iron- and steel-goods-factories[2]	113·07
Mechanical workshops	98·38
Wool- and cotton cloth-factories	89·61
Bar-iron works[3]	80·44
Sugar refineries[1]	73·65
Iron works[4]	73·53
Spinning mills	70·73
Paper mills[5]	64·14
Ore mines	58·12
Blast furnaces	53·39
Raw sugar factories	43·59
Malt liquor breweries[1]	40·60
Shoe factories	36·04
Metal-goods factories[6]	35·39
Joineries	30·83
Tanneries	30·36
Spirit factories[1]	30·19
Distilleries[1]	25·14
Margarine works	24·47
Book printing works	23·74
Electric machinery works[8]	23·43
Tobacco factories	23·03
Bakeries	21·20
Stone quarries[7]	20·17
Electric-power works	19·11
Sewing establishments	17·62
Match factories	16·57
Wharfs and dock-yards	15·97
Brick works[9]	15·62
Other industries	384·60
Total	**2 060·79**

[1] It should be remarked that, in evaluation, the increase of value in consequence of the excise is included. — [2] And foundries. — [3] Bar-iron, hammer- and rolling-mills. — [4] Iron-works for unrolled intermediate products. — [5] And board factories. — [6] Manufacture of metals other than iron. — [7] And stone-dressing works. — [8] Factories for the manufacture of electric machines and apparatus. — [9] And pottery-works.

culture, mining and allied manufactures form a very important source of livelihood for the people. Finally, in *northern* Sweden, agriculture is, to some extent, minimised by the timber industry, and, in the far north, by mining.

Bust of John Ericsson, Stockholm.

The characteristics that may be specially ascribed to Swedish industry are the employment of the very best materials — in some cases almost unnecessarily superior in quality — and, moreover, honest and careful workmanship. This last-mentioned characteristic of Swedish manufactures is due, in great measure, to the personal interest that Swedish artisans very frequently take in the work they have in hand, and their pronounced objection towards letting anything come from their hands that is not perfected to the best of their ability. On the other hand, it may be said that the mechanical skill in routine production possessed by the Swedish workmen is not always as great as might be wished; this, again, is due to the fact that production is often necessarily carried on on a small scale, precluding a thoroughly satisfactory distribution of special processes exclusively among specially expert hands. The result of these circumstances is that the products of Swedish industry are, as a rule, of excellent quality, but not infrequently so dear that it is difficult for them to compete with goods imported from countries where manufactures can be carried on on so much vaster a scale. A contributory cause to the expensiveness of Swedish manufactured goods is also the fact, to which

attention has latterly been called, that the Swedish workman not seldom lacks the desirable intensity in his labour, and that there is a want of proper organization of the direction and management of the work.

The facts enumerated above will be enough to account for only few of the branches of Swedish industry having succeeded in establishing an export trade on a large scale. To remedy this drawback is the immediate task set before industrial enterprise in the country at the present time, if it is to attain those dimensions which alone can render it of the economic importance desirable for the country as a whole. As has been pointed out several times in the foregoing pages, the prospects of a realization of these hopes seem brighter at present than in the past. As is well-known, the chief basis of these hopes is the immense motor-power possessed by Sweden in its many waterfalls (cf. below).

For **administrative** measures concerning industries and other branches of employment other than agriculture, there is a central official department called the **Board of Trade** (Kommerskollegium) one of whose three bureaus is intended for matters concerning the mining-industry, factories, etc. The State also endeavours to promote the development of industries by means of up-to-date *educational establisments,* partly for general technical instruction (cf. p. I, 417) and also, in certain cases, by means of special professional schools — the greater part of these, however, being of a private character — an account of which will be found in their proper sections in this book. The State also makes grants for *exhibitions,* etc..

TABLE 70. *Factory Industries in the Towns and in the Country Districts of Sweden in 1912.*[1]

Towns	Factories	Hands	Output in thousands of kronor	Towns	Factories	Hands	Output in thousands of kronor
Stockholm . .	774	29 048	178 864	Halmstad . .	63	1 307	10 529
Gothenburg . .	373	15 133	106 541	Södertälje . .	44	1 672	9 812
Malmö	340	10 916	86 458	Lidköping . .	43	1 138	8 193
Norrköping . .	179	8 509	50 790	Nyköping . .	45	1 431	7 976
Hälsingborg .	118	3 532	31 970	Huskvarna . .	9	1 739	7 672
Borås	101	4 933	28 252	Eslöv	42	646	7 547
Gävle	145	4 233	26 370	Karlskrona . .	50	2 158	7 365
Landskrona . .	68	1 871	25 152	Söderhamn . .	46	1 340	7 032
Västerås . . .	54	2 857	23 072	Linköping . .	77	1 215	6 810
Eskilstuna . .	156	5 151	21 632	Falkenberg . .	19	353	6 334
Kristianstad .	40	1 006	18 486	Uddevalla . .	39	1 363	5 907
Kalmar . . .	53	1 092	17 848	Vänersborg . .	26	1 135	5 410
Jönköping . .	93	4 290	17 562	Arvika	33	817	5 058
Örebro	102	2 888	17 130	Other towns .	1 049	19 414	93 996
Ystad	49	765	15 909				
Trälleborg . .	52	877	14 788	Towns	4 508	138 693	908 544
Uppsala . . .	94	2 317	14 010	Country distr.	7 820	203 665	1 152 249
Lund	65	1 714	13 013	The whole			
Karlstad . . .	67	1 833	11 056	kingdom . .	**12 328**	**342 358**	**2 060 793**

[1] It should be pointed out that, in many cases, large factory-industries are carried on in the immediate neighbourhood of towns; this is the case, for example at Gothenburg, Sundsvall, etc.: in the above table, consequently, such industry is placed to the credit of the country districts.

and gives stipendiums for journeys for the purpose of study, both to the leaders of the industries and to the workmen. An account is given in a special division in Part I of this work concerning the legislation aiming at the *protection* of workmen against the inconveniences and dangers they incur by their labour.

Annual **statistical reports** respecting the state of the various industries of Sweden have long been issued by the Board of Trade. Unfortunately, the execution of the work was, in earlier times, very defective, and no great importance can be ascribed to the Swedish factory-statistics before the year 1896 — after a special statistical bureau had been established in the Board of Trade, with a sufficiently large staff, and after the supplying of information to the national industrial-statistics had been made *obligatory* by a Royal Rescript, dated November 13, 1896. The existing Swedish factory statistics when compared with the corresponding statistics of other countries have, in spite of undeniable shortcomings, above mentioned, the merit of giving a y e a r l y survey of most industries.

A large number of special associations have been formed for the promotion of Swedish industries. In addition to these, there exists a general organization, *Sveriges Industriförbund* (The Industrial Association of Sweden), the aim of which is to combine the manufacturers, etc., of the country and the associations of the various branches of industry, for the purpose of protecting their common interests and, more especially, of directing the attention of the Government authorities to the needs of industry. At the present moment the Industrial Association embraces 371 factories, employing a total of 114 000 hands (end 1914).

In drawing up here the list of the various branches of industry, the **division** is employed that is made use of in the official factory-statistics, against which, it is possible, criticisms respecting details may be made, but which have the great merit of being connected with that employed for the last four decades in the commercial-statistics, a fact which of course, facilitates comparisons between the manufactures, the imports and the exports.

Before proceeding to a detailed account of the manufacturing industries, some words may be said here respecting one of the most important factors for the industries of the country in general, viz., *the Swedish waterfalls.*

Waterfalls of Sweden.

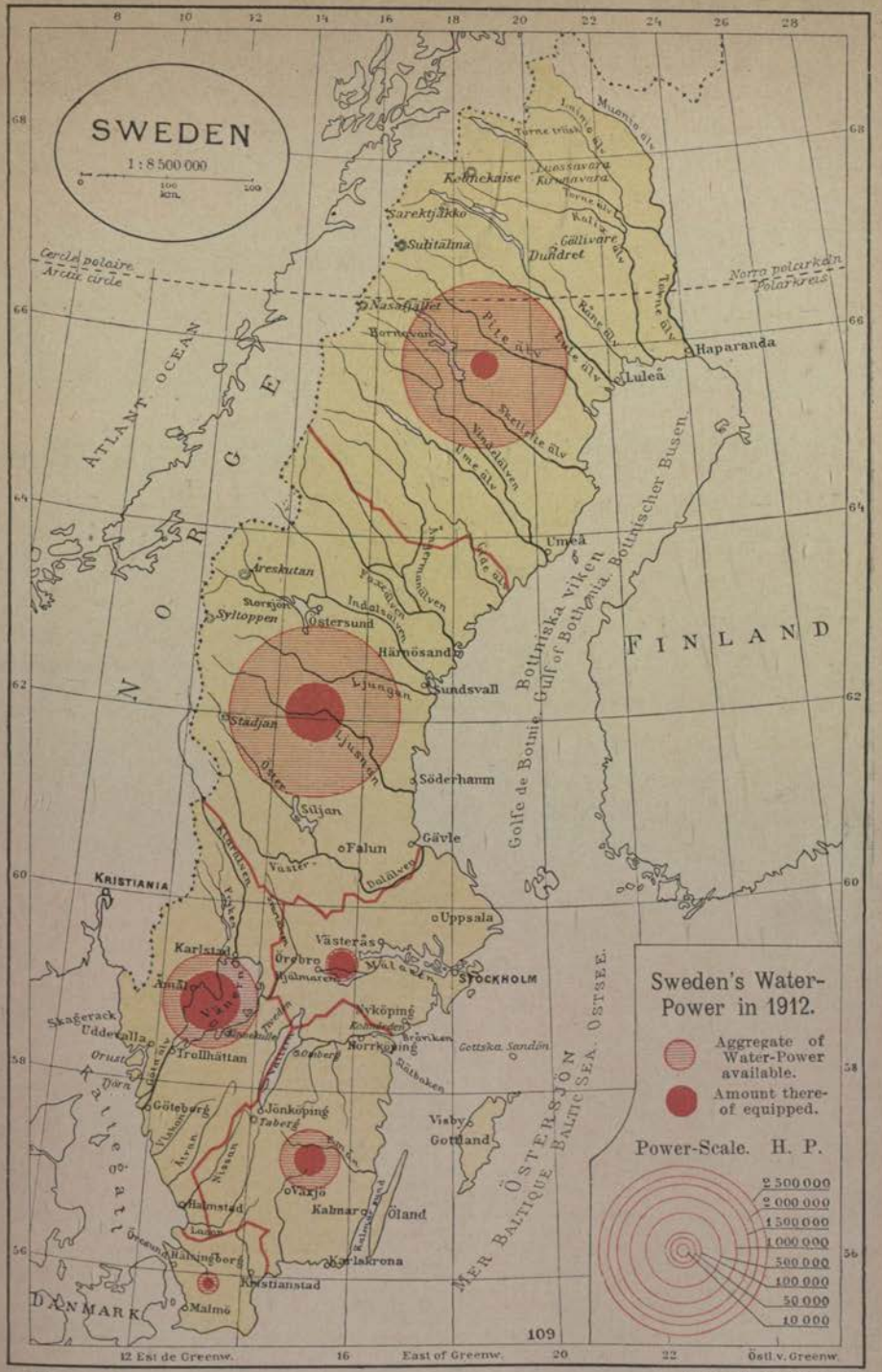
Sweden is, with regard to the supply of water power, one of the countries in Europe which Nature has most favoured. It is true that reliable data as to the measure of Sweden's water-power are still lacking, but a rough estimate has given the result of 10 million horse-power, available during from six to nine months of the year. Another estimate has led to a final figure of 6 $^{8}/_{4}$ million turbine horse-power, available during nine months of the year. Full certainty in this respect can obviously not be

gained except by a thorough registration based on detailed investigations. This work has in fact been started in the shape of the "*Register of Waterfalls*" *(vattenfallsförteckning)*, which, in conformity with the resolution of the Riksdag of 1910, is being drawn up by the Board of Waterfalls and by the Hydrographic Bureau, the first pages of which issued from the press at the beginning of the year 1913. This work, however, will take many years. An approximate estimate of the measure of the water-power in Sweden, based on certain assumptions, has recently been made by M. Serrander, Lieutenant in the Royal Engineering Corps and will be found as an appendix to part V of "*Finansstatistiska Utredningar, utgivna genom Kungl. Finansdepartementet*" (Financial and Statistical Investigations published by the Royal Finance Department), plublished in 1912 and prepared under the direction of I. Flodström. The exact title of the said part V is "Sveriges nationalförmögenhet omkring år 1908 och dess utveckling sedan mitten av 1880-talet" (The National Wealt of Sweden about the year 1908 and its Development since the middle of the eighties). In this work the water-power of Sweden is estimated at 6·2 million turbine horse-power, which can be utilized for about 9 months in the year.

For the purpose of comparison with these figures, it may be mentioned that Norway, from where also there are no exact data forthcoming, is stated to possess about $7^1/_2$ million turbine horse-power available during nine months in the year, and that Finland has 2·6 millions at average water level. Austria is said to possess 6·1 millions, France 5·9, and Italy 5·6 millions. Next come Switzerland with 1·5, Germany with 1·4, and Great Britain with 1 million; all in turbine horse-power, in round numbers and available during nine months of the year.

If Sweden has thus a very considerable supply of water-power, that power, however, has not as yet possessed a very high value. Most of it is to be found in the interior of the country, where the population is sparse, communications but little developed, and the prospects for industrial enterprise as a rule not very great.

On the other hand, *the abundance of lakes* in Sweden constitutes an extremely favourable factor in the rational utilization of water-power. For not only does the accumulating and regulating action of the lakes render the natural flow much less fluctuating than in other countries not so well supplied with lakes, but this action of the lakes can as a rule be still further utilized at moderate expense by the erection of regulating dams at the outlets of the lakes. The out-of-the way situation of the waterfalls, moreover, is not a matter of so much consequence as heretofore, when the utilization of the water-power was restricted in consequence of the impossibility or the difficulty of *transmitting energy over long distances from the source of power*. Especially the discoveries of recent years have produced a revolution in this respect, since it has been proved that electric power transmissions can work at tensions hardly dreamt of a few years ago. What a solution of the storage battery problem would signify for Sweden will at once be realized. In this connection it may be pointed out



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that several of the modern electro-chemical branches of industry are not very dependent on their locality and can often utilize even that part of the water-power which is only available during certain parts of the year.

The *Distribution of Waterfalls.* How the waterfalls are distributed over Sweden will be seen from the following figures, taken from the work cited above, "Sveriges nationalförmögenhet":

The Stora Sjöfallet Falls in the river Lule älv.

	Turbine horse-power.		
	State	Private	Total
Central Sweden	6 610	80 390	87 000
South-East Sweden	28 150	278 850	307 000
Skåne	380	36 620	37 000
West Sweden	258 240	545 760	804 000
Lower Norrland and Dalarne	100 620	2 459 380	2 560 000
Upper Norrland	646 330	1 763 670	2 410 000
Total	1 040 330	5 164 670	6 205 000

The water-power owned by the State thus forms 16·7 % of the total. Among State waterfalls have been included those entered in the register issued by the Royal Committee on Waterfalls of 1903, with the modifications necessitated by purchases subsequently made and by other circumstances. On the other hand, for obvious reasons, consideration has not been paid to the changes of proprietary rights which may result from

the legal actions instituted in recent years by the State, with the object of establishing the State ownership of a large number of waterfalls which have hitherto been regarded as the private property of the riparian owners.

A rough estimate of the water-power which, with suitable regulation of lakes, can be utilized with profit has shown that it amounts to about 3·8 million horse-power. In "Sveriges Nationalförmögenhet" the aggregate amount of the water-power which has already been equipped, or is of such a nature that it may be excepted to be equipped before 1959 is estimated at 3 511 540 turbine horse-power, distributed as follows:

	Turbine-horse-power
Central Sweden	83 600
South-East Sweden	280 270
Skåne	27 120
West Sweden	680 000
Lower Norrland and Dalarne	1 537 710
Upper Norrland	902 840
Total	**3 511 540**

Out of this total, about 750 000 turbine horse-power or 21 % should be equipped at the end of 1913, and out of that amount again, 654 000 turbine horse-power by private or communal enterprise, and the remainder, about 96 000 turbine horse-power by the State. The State power works at Trollhättan are included in this estimate with 80 000 turbine horse-power.

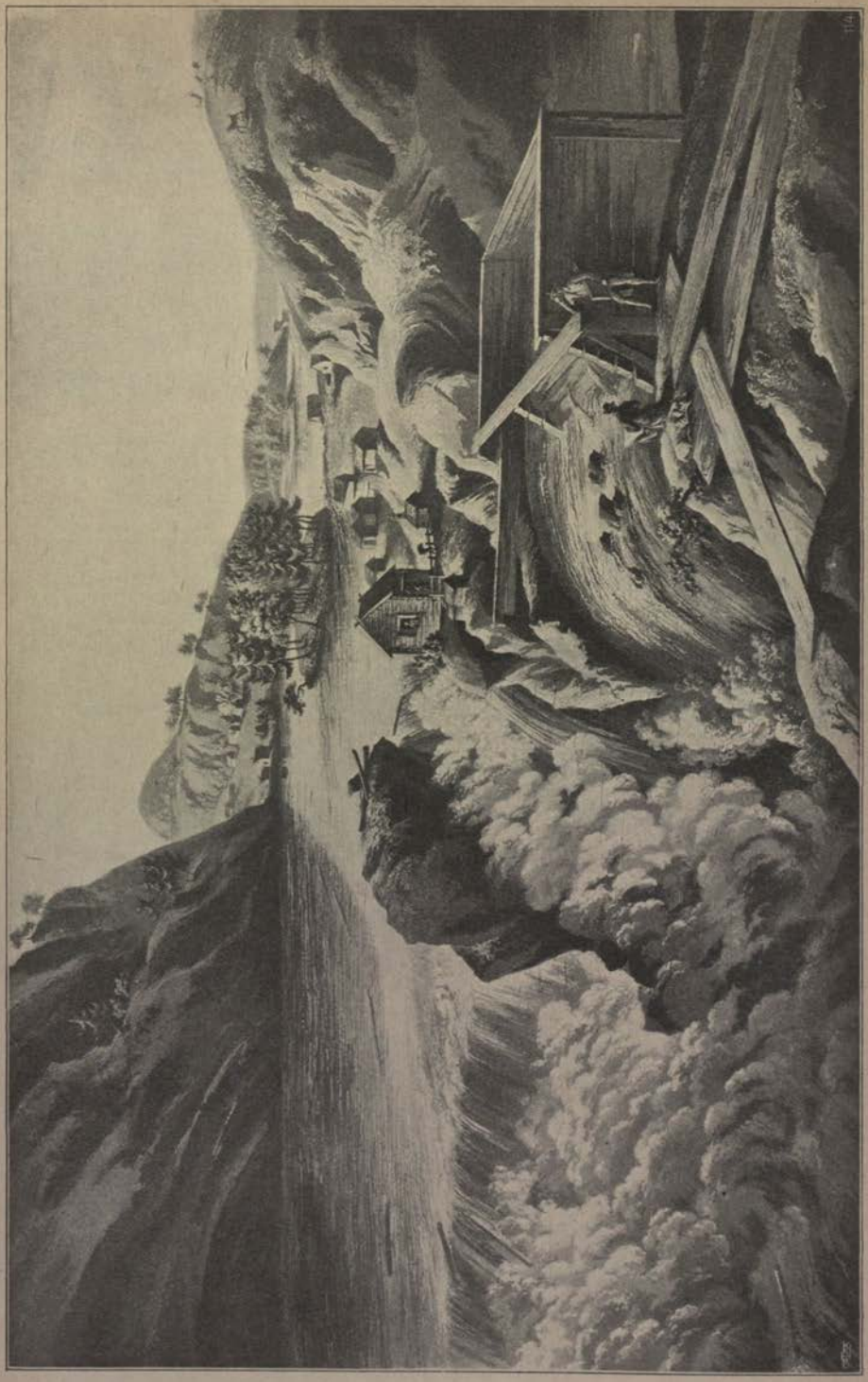
If we include the works now in process of construction at Porjus and Älvkarleby and the works being constructed by the City of Stockholm at Untra, the corresponding figures will be: 870 000 — 25 % — 692 000 — 178 000.

In the above figures are not included a great number of plants of less than 100 turbine horse-power, which, if included, might increase the total amount of installed turbine horse-power by some 50 000.

If we observe how the utilization of water power has developed in different parts of the country, we shall find obvious proofs of the influence that the geographical position of the sources of power has exerted on their utilization. The relation between utilized and available water-power (the latter according to assumptions made in "Sveriges Nationalförmögenhet") at the end of 1912 then figures out as follows:

	At the end of 1913	Do., incl. of Trollhättan, Porjus, Älvkarleby, Untra[1]
Central Sweden	74·0 %	74·0 %
South-East Sweden	29·0 »	29·0
Skåne	13·5 »	13·5
West Sweden	40·0 »	40·0 »
Lower Norrland and Dalarne	9·5 »	12·5
Upper Norrland	1·0 »	2·7 »

[1] The Älvkarleby and Untra plants are here (according to assumptions made in "Sveriges nationalförmögenhet") reckoned as belonging to Lower Norrland and Dalarne.



The Toppö Fall at Trollhättan about 1800. After copperplate by J. F. Martin.

The accompanying map should furnish a clear idea of the distribution of water-power in Sweden, and also of that portion of it which has been actually utilized. The total supply of economically available water-power has for this purpose been assumed to be 6 200 000 horse-power.

It may also be of interest in this connection to give the latest available official data as to *power consumption for industrial purposes*. In the statistics of the Board of Trade for 1910 and 1912 we find the following figures:

	Mines		Factories		Total	
	1910	1912	1910	1912	1910	1912
Total power for direct running	68 422	78 280	417 873	410 571	**486 295**	**488 851**
Total power for running electric generators	31 173	33 222	393 911	579 519	**425 084**	**612 741**
Total	**99 595**	**111 502**	**811 784**	**990 090**	**911 379**	**1 101 592**
Amonunt generated by water-power for direct running	46 421	48 741	207 001	200 635	**253 422**	**249 376**
Amonunt generated by water-power for running electric generators	20 005	19 194	272 236	429 137	**292 241**	**448 331**
Total	**66 426**	**67 935**	**479 237**	**629 772**	**545 663**	**697 707**

These figures show that respectively 60% and 63% of the total power consumed was by water-power. They show also that, while during the year 1910 about 46 % of the total water-power used, was still consumed by direct shafting without electric transmission of power, this same figure for 1912 has declined to 36%. There is no doubt that the near future will see a still more remarkable change in this respect, as by far the greater part of the water-power recently equipped or now in process of equipment — the latter amounting to about 100 000 turbine horse-power — will apparently be transformed into electric energy for transmission over shorter or longer distances.

One may classify the water-power plants equipped at the end of 1913 as follows:

Size of equipment in turbine HP	Number of plants	Total number of turbine HP
50 000 or more	1	80 000
25 000—50 000	2	68 000
10 000—25 000	6	109 000
5 000—10 000	18	116 000
1 000—5 000	126	245 000
200—1 000	296	132 000
Total	**449**	**750 000**

The utilization of the water-power for different purposes is given approximately in the following table:

	Number of turbine HP	
Iron-industry	215 000	29
Paper and pulp industries	240 000	32
Textile industry	40 000	5
Electro-chemical industry	90 000	12
Power-distribution,[1] and various	165 000	22
Total	**750 000**	**100**

[1] The larger industrial subscribers for energy from the electric generating stations are not included, as they have been included under their respective groups.

The value of Swedish Water-Power. It would seem to be a very delicate matter to estimate aright the *value* represented by Swedish water-power. However, in "Sveriges Nationalförmögenhet" an attempt has been made. In this preliminary estimate the basis for calculation has been partly the prices actually paid on the sale of certain waterfalls, partly statements as to the profit made by certain water-power enterprises which may be assumed to have come into normal working order. The results yielded by this estimate are a capital value for the north of Sweden of, on an average, 75 kronor, and for the south of Sweden of, on an average, 90 kronor per turbine horse-power for the waterfalls which in 1908 had been equipped or were in process of equipment. Further, the estimate has been extended to the corresponding value of the waterfalls which it may be assumed will be equipped in the course of the next fifty years, distributed in different groups, and this value has been reduced to the year 1908 at 6% interest for private enterprises and 4·5 % for State enterprises.

The outcome of this preliminary computation is that Sweden's water-power "fit to be equipped" may be assumed to represent in 1908 a total value of 138·6 million kronor, out of which 21 % fall to State enterprises, and 79 % to private enterprises.

This figure is surprisingly low. But, in the first place, the rate at which the utilization of water-power is assumed to take place during the term of 50 years in question seems to have been rather cautiously estimated, since the basis of calculation has been that 3 million horse-power would be equipped during this period of fifty years, that is, on an average, 60 000 horse-power per annum, or about the same amount of power as was added in each of the years 1912 and 1913. However, as far as can be judged at present, the immediate

Photo. L. WESTFELT, Porjus.

The Porjus Falls.

The Trollhättan Power Station.

prospects for Sweden's water-power lie in its appropriation to electro-chemical and electro-thermic industries, and those industries require very great amounts of power. Thus for instance, at Svaelgfos and Rjukan in Norway, no less than 290 000 horse-power are consumed almost entirely for a single industrial establishment of this kind, and the 18 000 horse-power output of the recently built Ljunga Works is taken by a single lime-nitrogen factory. Nor has consideration been paid to what the development of electro-technics can and must achieve half a century onwards.

The direct valuation is not of so much consequence. The main importance in estimating the value of water-power must be laid not on the direct earnings but in a very special degree on the *indirect profit*. For the increased use of water-power signifies increased independence of foreign fuel, increased industrial progress, and increased economic strength,and increased self-reliance. And from this point of view the water-power of Sweden constitutes a very material portion of her national wealth.

In Sweden, with her dearth of coal, water-power has been used for centuries: at first for the small, but very numerous mills, saws, and hammers, afterwards for big industrial plants, for iron works and for mines, textile and cellulose industry. Even before electric transmission of power had proved to be a practicable possibility, which was in the nineties, the energy of the waterfalls was transmitted over considerable distances. We need only remind the reader of Polhem's famous rod-and crank transmissions *(stånggångar)*, which are still in use in some places, as for instance

Grängesberg. The technical success of electric power-transmission opened up new possibilities for the use of water-power, and these possibilities were soon seized upon by far-sighted men in Sweden. The first water-power works, whose mission it was to transmit electric energy over greater or smaller areas and vend it to different consumers, so-called överlandscentraler (over lands central stations), were constructed by private enterprise. Those that were first in the field were The Builders of Hissmoforsen and Skråmforsen, further Yngereds Kraftaktiebolag, Hemsjö Kraftaktiebolag, Gullspångs Kraftaktiebolag, and Sydsvenska Kraftaktiebolaget.[1] Later on the State herself appeared on the scene and built the big power works at Trollhättan, the first section of which was completed in 1910, those at Porjus, and those at Älvkarleby, the former of which is to be finished and in working order in 1914, and the latter in 1915.

A considerable amount of energy is now disposed of for electro-chemical and electro-metallurgical purposes. Electric furnaces are thus working for different purposes:

For pig iron at Domnarvet, Hagfors and Trollhättan, for zinc at Trollhättan, for ferrosilicium and ferromanganese at the same place, as well as at Vargön and Gullspång, for clorates at Månsbo and Alby, for carbide and cyanamide at Alby and Ljunga-works.

(See, further, sections on iron-manufacturing and other industries.)

For several years plans have been rafted for the electrification of the State railway system. An important section of it, "Kiruna—Riksgränsen", carrying the large iron-ore traffic from the mining districts of Lappland will be run electrically this year, receiving energy from the State water-power station at Porjus.

Evidence of the interest in the development of the water-power of the country is also afforded by the foundation of the "Svenska vattenkraftföreningen" (the Swedish Water-Power Association), a union of communal and private water-power concerns, and of private persons. The aim of the Association is to promote the utilization of Sweden's water-power by the spread of technical, economic, and legal information in the matter.

Symptomatic of the interest evinced by the State in the exploitation of water power is the creation of two new Government offices: **Hydrografiska Byrån,** the Hydrographical Bureau, in 1908, and **Vattenfallsstyrelsen,** the Board of Waterfalls, in 1909, the latter replacing the Trollhätte Canal and Water-Works Board, established in 1905.

The Hydrographical Bureau. It devolves on the Hydrographical Bureau to collect and work up all such data as may be necessary for an exhaustive and practical working knowledge of the hydrography of the Swedish fresh water lakes, rivers, etc, and to make observations and measurings for that purpose. The Bureau shall make its results accessible to the public by the publication of year-books, monographies on rivers, treatises, and essays. Above all, the Bureau is responsible for the editing and publication of the above-mentioned "Re-

[1] *Kraftaktiebolag* = Power Company. *Fors* = Falls. *Syd-svenska* = South Swedish.

gister of Waterfalls". This Register contains information on the flow of water in the rivers at different water-levels, heights of falls, geological data, and so forth, and should prove to be of great benefit for the development of the water-power industry. The Hydrographical Bureau also, insofar as its time allows, undertakes, investigations and surveys for communes and private persons for which certain fees are charged.

The Board of Waterfalls. The principal duties of the Board of Waterfalls, in regard to water-power in Sweden, are to adopt measures calculated to encourage its exploitation. For this purpose it constructs and manages the State's own power works and is entitled to utilize the waterfalls which are not equipped for the State, by leasing them to private persons or concerns. The planning and advancement of lake-regulation works also falls within the work of the Board. The Board is composed of a Chairman and Director, "Vattenfallsdirektören", who devotes all his time to the business of the Board, and four members who take an active part only in the treatment of more important matters. These members act in the capacity of expert advisers in various practical spheres, such as technique, commerce, industry, and law, and place the Board in intimate communication with the needs of practical life. In the treatment of special questions, such as those coming within the sphere of activity of the Board of Agriculture, the Crown Lands Board and the Railway Board, representatives of those bodies shall take part in the deliberations, but not in decisions. However, in case one of these delegates records an opinion at variance with the decision of the Board, that decision shall be submitted for the consideration of Government. Thus, it is intended that the Board of Waterfalls shall as far as possible see matters from the practical point of view, moreover, in virtue of the regulations of December 31, 1908, and of other resolutions, the Board is armed with powers as to the conclusion of contracts, etc. which are less restricted than is the case generally within the State Administration.

It is under the superintendence of the Board of Waterfalls that the big State power stations have been erected or are in process of erection, notably those at Trotthättan for 80 000, those at Porjus for 50 000, and those at Älvkarleby for 45 000 turbine horse-power.

Especially in the case of the two first-named stations there will be great possibilities of further development, when the two sources of water-supply, Lake Vänern and the Luleälv, have been regulated, while the Älvkarleby station has been planned with a view to the regulation of Lake Siljan. The Board have such regulation-problems under consideration.

The leasing of State waterfalls, on the other hand, has proceeded rather languidly; partly because the State waterfalls are, as a rule, less suitably located than a number of those in private hands; partly because it is more difficult to procure credit, as mortgages on the property cannot be given as security. An attempt has been made to remove the last-named difficulty by a Resolution of the Riksdag of 1911, which amplifies the leasing conditions with regard to certain Crown waterfalls as laid down by the Resolution of the Riksdag of 1910; the added clauses introduce a new legal right, "*waterfall rights*" *(vattenfallsrätten)*, which is similar to ground rights and allows of the conveyance being mortgaged. In devising these forms for the conveyance of the State waterfalls, the chief object kept in view was to mitigate the effects of the legal actions alluded to above, and that in such a wise that the proprietor of a waterfall in dispute should be enabled to conclude a conditional contract for the conveyance of the

waterfall at a small rental and for a long period of time, which contract was only to come into force in case the Crown was awarded the proprietary rights. In this manner the present proprietor would be secured in the right to use the water-power for a considerable time to come, even if the finding of the court went against him. However, in actual practice these "waterfall rights" have not hitherto been made use of, the reason apparently being the novelty of the legal form, and the fact that lenders prefer to take an ordinary mortgage on real property.

One way of encouraging the conveyance of waterfalls with such rights would be, obviously, that the State itself should step forward as a lender. In fact, in the Riksdag of 1912 a bill was introduced to investigate the question of the *creation of a loan fund* for users of State waterfalls with waterfall rights, and the Riksdag passed the bill. In the following year, a supplementary bill was brought forward proposing that the investigation thus called for might likewise be extended to a loan fund for the users of waterfalls in private hands.

In conclusion, as a step in the waterfall policy of the State, it may be pointed out that the Crown has purchased several large waterfalls from private persons and concerns, partly in order to hold them in reserve for a future electrification of the State railways, partly in order to complete its property in certain river areas. Among the latter purchases are to be noted those in virtue of which the State has acquired practically sole ownership of all the water-power in the River Göta älv between Lake Vänern and the Sea.

But the State can and should encourage the utilization of water-power even in other ways than those just indicated, namely by framing its *legislation* in such a spirit that the least possible obstacles shall be encountered and the greatest possible promptitude effected in the legal treatment of questions relating to the construction of power works and dams. In this respect much remains to be done.

True, Sweden posses a Water Act of such a recent date as the Royal Ordinance "concerning the landowner's right to the water on his land", of December 30, 1880, supplemented by Royal Proclamation of October 20. 1899 "concerning regulations to be observed by those desirous of acquiring a license from the King to build on a Crown water-course *(kungsådra*[1]*)*". But the regulations of that act do not by any means satisfy the legitimate demands of the modern water-power industry. Not only is the legal and administrative procedure far too cumbrous and slow and leaves too little scope for expert knowledge, but the law actually places obstacles in the way of a rational utilization of water power, and in many cases renders it impossible. In the last respect it is specially to be noted that the law does not concede the right of expropriating ground for the actual power

[1] The purpose and definition of the term "Kungsådra" ("Kings artery") will be found in the second section of paragraph 7 of the said Royal Proclamation. Cf. also the article on Fishing.

station, and that it does not provide facilities for a water-power user to effectuate the regulation of a lake or the damming up of water, supposing damage thereby to be caused to a building, waterfall, or the like, belonging to another, no matter how great the public benefit accuring from the enterprise. On the other hand, by the Electric Installations Act of June 27, 1902, the water power industry has been tolerably well provided for, with reference to the right to carry over another ground the electric power lines often imperatively necessary for modern power works.

A revision of the Water Act was set on foot in 1906, when the Government appointed a committee to draft proposals for new legislation with regard to a landowner's rights over the water in his ground. That committee, jointly with another committee of same year appointed to draw up proposals for amendments in the law relating to the drainage of ground, brought forward on the December 17, 1910, a scheme for an amended Water Act. This extensive scheme, which contains many new and remarkable suggestions, is at present being considered by the authorities. Furthermore, of late a scheme for a new floating law, as well as a new bill providing for greater security with regard to agreements for delivery of electrical energy, etc., have been worked out. It is to be hoped that the Riksdag will soon see its way to decide this very important question, and that the new law will be framed in such a spirit that it will not impede, but facilitate and encourage the speedy and scientific exploitation of Sweden's water power.

The formal stumbling-blocks once removed, there is no doubt whatever that the people of Sweden will contrive, within a not too far distant future, to turn to account the national wealth which lies in her magnificent supplies of water-power, and which, utilized in the right way, should give her an extremeley favourable position in the competition going on between the nations.

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1. ARTICLES OF FOOD AND CONSUMPTION.

This large group, which embraces about $^1/_4$ of the industrial products of Sweden reckoned according to value, may be subdivided — in accordance with the nature of the raw materials employed, or with that of the products in question — as given below, the figures being for the year 1912:

	Factories	Hands	Value of production	
Products from Grain and Root crops	1 744	7 769	155 042 000	kronor
Dairy produce (Figures for 1910)	1 416	4 155	95 454 000	»
Other Food-stuffs from the animal kingdom .	118	1 911	49 204 000	»
Sugar, Chocolate, Tobacco, etc.	292	16 007	165 094 000	»
Drinkables, etc.	1 186	8 019	106 802 000	»
Total	**4 756**	**37 861**	**571 596 000**	kronor

TABLE 71. *Imports and Exports of Articles of Food and Consumption.*

Annually	*Imports.* Value in thousands of kronor				*Exports.* Value in thousands of kronor				Excess of imports, thousands of kr
	Produce of agriculture and fishing	Colonial produce	Other commodities	Total	Produce of agriculture and fishing	Colonial produce	Other commodities	Total	
1871—75 .	36 876	37 101	10 950	**84 927**	43 759	72	492	**44 323**	40 604
1876—80 .	55 593	44 076	8 939	**108 608**	48 846	97	1 143	**50 086**	58 522
1881—85 .	62 436	40 604	13 110	**116 150**	47 803	177	2 274	**50 254**	65 896
1886—90 .	46 036	50 115	12 151	**108 302**	58 879	691	3 437	**63 007**	45 295
1891—95 .	50 304	47 688	12 071	**110 063**	74 480	1 136	1 203	**76 819**	33 244
1896—00 .	61 224	40 952	17 073	**119 249**	53 362	301	1 375	**55 038**	64 211
1901—05 .	84 462	39 260	20 702	**144 424**	46 884	468	2 509	**49 861**	95 463
1906—10 .	79 880	44 759	21 031	**145 670**	52 894	568	2 739	**56 201**	89 469
1910 . . .	77 121	47 579	23 216	**147 916**	61 642	462	2 145	**64 249**	83 667
1911 . . .	69 450	59 479	24 301	**153 230**	78 322	938	1 958	**81 218**	72 012
1912 . . .	91 720	60 306	26 328	**178 354**	88 404	752	1 603	**90 759**	87 595
1913 . . .	94 116	60 086	26 845	**181 047**	84 483	686	1 652	**86 821**	94 226

The dairy-farming industry has already been dealt with in the previous pages.

A survey of the imports and exports of Sweden, of articles belonging to this group, is given in Table 71 above.

Sweden is, therefore, obliged constantly to purchase articles of food, on a considerably larger scale than it can export the same articles. The amount of the difference is shown by the last column of Table 71 above. Even if we deduct what is called *colonial produce*, the most important of which is *coffee* — of which, in 1906—10, the imports amounted on an average to 32 million kronor annually, and in 1913 to 39·4 million kronor — there is still a considerable excess of imports. This, it is true, is diminished by the export-excess of *living cattle*, but, on the other hand, is increased to a still higher degree by a very great excess of imports for cattle-fodder, which, in 1913, amounted to about 30 million kronor.

Flour Mills.

In all parts of Sweden there are numerous mills, usually rather small, to which the people of the neighbourhood take their corn to be ground. These mills are, as a rule, driven by the *waterfalls* along the streams and rivers in which Sweden abounds. It is only along the coasts and in a few provinces, such as Skåne and Västergötland, which have large expanses of flat country, that *windmills* are found, owing to the dearth of waterfalls. In spite of the improved construction of both water motors and wind motors, whereby the mills have been enabled to utilize the forces of nature to better effect, steam has gradually made its way into the mill industry, and to some extent modified its character: for **steam mills** can be erected anywhere, even in large commercial centres, where the mill

industry is always combined with the flour trade. Many a farmer who used to have corn for his own household ground at the nearest mill, now finds it worth his while to sell his corn and buy his flour. The chief reason is that the flour from the industrial mills, especially wheaten flour, is greatly superior in quality to home-ground flour; this is due to the fact that the industrial mills do not take their corn from one district only, but blend together corn from places far apart; thus the occasional differences in quality are to great extent neutralized. Further, Swedish wheat does not, on the whole, possess the most suitable composition for baking purposes: in order to produce a really good baking flour, it is necessary to blend it with harder kinds (richer in gluten) e. g. Russian wheat. For this reason a great deal of Russian or Hungarian flour used to be imported and mixed at the bakeries with the Swedish. The advent of industrial mills has changed this: the corn itself is now imported. By dint of judicious selection the industrial mills can now obtain a mixture which yields a flour satisfying the most exacting requirements, and since at present there is only a small quantity of flour produced solely from Swedish wheat, the importation of highly glutinous flour is no longer necessary.

Although *rye* is, in point of quantity, the most widely used grain in Sweden for breadmaking purposes, the output of rye flour from the industrial mills is generally of secondary importance. The explanation of this is that only a small proportion of rye-flour consists of sifted flour. The national "hard bread" (hårt bröd), which is the bread par excellence in the country districts, is made almost solely of bolted flour. As the making of such flour is a very simple process, and therefore suitable for very small mills, the farmers generally have their rye ground to bolted flour at the small mills in their own districts. In the year 1912 there were 1 356 mills with 1 822 pairs of rollers and 4 724 pairs of stones. The whole output was 5 969 878 quintals of flour, groats, bran and grits, of which 3 999 486 quintals were flour; among the larger mills of Sweden may be mentioned: Saltsjökvarn and Tre Kronor in Stockholm, Uppsala Ångkvarn (steam mill), J. G. Swarts' Kvarnverk, Norrköping, Kalmar Ångkvarn, Mårten Persons Valskvarn (roller mill), Kristianstad, Trälleborgs Ångkvarn, Malmö Stora Valskvarn.

The development of the mill industry during the last years is shown by Table 72.

As shown in the Table 72 the *import* of flour, groats and bran has decreased in recent times. As the import of unmilled grain has at any rate not decreased,

TABLE 72. *The Mill Industry.*

Annually	Number of mills	Number of workmen	Output quintals	Value of output thousands of kr.	Import quintals	Export quintals
1901—05	1 627	4 481	5 410 228	92 243	1 208 185	61 526
1906—10	1 447	4 161	5 509 807	105 777	1 058 918	66 513
1910	1 384	3 975	5 612 283	106 392	1 176 667	56 241
1911	1 381	4 017	5 799 076	108 613	761 891	122 972
1912	1 356	4 003	5 969 878	118 194	818 728	305 127

and the home crops have actually increased, it is manifest that the milling industry has enlarged its scope considerably, and since, as already mentioned, the large factory mills driven by machinery have been gradually ousting the small mills of former days, the output of the big steam mills must evidently have increased still more.

Margarine Industry.

The raw material out of which margarine was originally made was simply fresh, unclarified *tallow*, obtained from horned cattle. This tallow is melted in water at a temperature of about 50°—60° C., so as to form what is called "premier jus", which is then allowed to solidify at about 30° C., after which it is placed in cotton cloths and exposed to high pressure, whereupon a fluid portion, called *oleo-margarine*, is obtained, together with a solid mass called *pressed-tallow*. The *oleo-margarine* is then mixed with milk and churned, and afterwards manipulated like ordinary butter, the product obtained being margarine. Oleo-margarine alone, however, is, in general, too hard to give a fully satisfactory substitute for butter, so that, before the process of churning, pure *vegetable oils*, such as cotton-oil, sesam oil or pea-nut oil are added, these substances also contributing to make the margarine cheaper. In accordance with a Royal Regulation of October 13, 1905, margarine, in order that it may be easily distinguished chemically from butter, must contain at least 10 % of sesam oil "of all the fat and vegetable oils, sesam oil therein included, employed in the manufacture". In the superior kinds of margarine, we find among these ingredients the best *lard*, so-called neutral lard, together with natural (ordinary) butter, in considerable quantities. During the last few years, considerable progress has been made in the margarine industry, in consequence of the fact that, after efforts made during the preceding 25 years, it was at length found possible to clarify *cocoa-nut oil* and *palm-kernel oil* so that they remain fresh and of agreeable taste, and can thus be employed in the manufacture of margarine. In such *vegetable margarine* (as it is called, in order to distinguish it from *animal-margarine* with oleo-margarine and lard as the principal raw ingredients), there exists no oleo-margarine, but only some of the above-mentioned purified oils, together with the vegetable oils also mentioned above. Vegetable margarine has a purer taste than the animal product, and is therefore better suited for direct consumption, while, on the other hand, the margarine prepared from animal ingredients is better for baking and cooking in general. Since the beginning of 1910, vegetable margarine has supplanted the animal product, so that the greatest part of the margarine consumed now consists of vegetable margarine. This is the result, not only of the better taste in the case of the vegetable margarine, but also its lower price which is about $^2/_3$ of that of the animal margarine of the same quality; at the same time, the price of cocoa-nut oil and palm-kernel oil has, consequently, risen, and nowadays these oils are for the most part employed for the manufacture of margarine, instead of being devoted to the manufacture of soap as they formerly were. If the selling-price of the better class of animal margarine is about $^2/_3$ of that of ordinary butter, that of vegetable margarine is not more than about half of the latter, so that vegetable margarine forms a very good and cheap nutriment for the masses.

The manufacture of margarine was first begun in France in 1869 by Mège-Mouriès. In Sweden the first margarine factory was built in 1881, at Hälsingborg, and in 1912 the country possessed 10 margarine-factories employing 585 workmen. *The consumption* of margarine in 1912 was about 23 million kg, corresponding to 4·1 kg per head of the population per annum while, in Denmark, for example, it is about 12 kg, or 3 times as much as in Sweden. Table 73 gives a survey of the development of the margarine industry in Sweden.

TABLE 73. *Margarine* (acc. to the official statistics).

Annually	Manufacture kg	Cost of production öre pr kg	Import kg	Export kg	Consumption kg
1886—90	216 377	93	543 375	5 696	754 056
1891—95	1 840 745	84	791 910	52 494	2 580 161
1896—00	6 122 913	83	1 185 930	93 975	7 214 868
1901—05	12 503 813	107	55 410	222 786	12 336 437
1906—10	14 237 920	116	40 284	130 364	14 147 840
1910	16 337 418	118	128 906	91 909	16 374 415
1911	19 062 467	95	173 990	41 235	19 195 212
1912	22 887 787	107	147 829	22 141	23 013 475

According to the Royal Regulation of July 1, 1898, which has since undergone several alterations, the manufacture of margarine is now under the superintendence in every factory of a Comptroller, specially appointed by the governments of the respective läns, but, on the other hand, there is no security that *imported* margarine is manufactured under any kind of control; this fact, nowadays, since the *import* has almost come to an end, is a matter of less importance than it formerly was. *The sale* of margarine is also subjected to certain regulations, in order that the article may not be taken as, or employed for the adulteration of, natural butter. Margarine-cheese must be coloured red exteriorly, and not less than 5 % of its fatty constituents must consist of sesam oil.

In this connection it may be mentioned that, in 1911, the manufacture in Sweden of "premier jus" amounted to 566 844 kg, while 2 816 979 kg were imported; the corresponding figures for oleo-margarine were 1 409 908 and 336 805 kg, while of 9 591 742 kg imported cocoa-nut oil, 8 127 916 kg, or 85 %, were employed for the manufacture of vegetable margarine. [1]

Since 1912, there has existed in Kalmar a factory for the purification of cocoa-nut oil and palm-kernel oil for the manufacture of margarine.

Manufacture of Beet-Sugar.

As far back as between 1830 and 1840, attempts were made in Sweden to manufacture beet-sugar, but the factories then started soon had to be closed down, as the percentage of sugar extracted was too small. Though experiments were renewed from time to time, especially in the beginning of the seventies, the industry cannot be said to have really taken firm root in Sweden until the first half of the following decade.

In 1913, there were 24 *factories* making beet-sugar in Sweden, of which one was in Gottland, one in Öland, one in each of the Läns of Blekinge, Östergötland, Västergötland, and Halland, and the rest in Skåne. Of the latter, three were so-called juice-stations (see below). The Swedish sugar factories, as regards technical equipment, are fully abreast of the times; the larger of them are capable of working up as much as 1 000 tons of beet

[1] Some of the figures in this section are not in full agreement with those of the official statistics, as the latter are somewhat incomplete. The correct figures have been gained from reports, obtained direct from the margarine factories by the Committee which was appointed by the Board of Trade, in the spring of 1911, for the purpose of drawing up proposals for alterations in the duty on margarine and its raw materials.

TABLE 74. *Manufacture of Beet-Sugar in Sweden.*

Annually[1]	No. of factories	Beet-land	Beet worked	Production in quintals		Percentage of Yield[3]	
		Hectares[2]	Quintals	Raw sugar	Molasses	Raw sugar	Molasses
1876—80 . . .	1	400	113 300	9 472	—	8·34	—
1881—85 . . .	2	1 100	327 124	28 505	12 635	8·69	4·06
1886—90 . . .	4	4 000	1 162 286	118 241	37 354	10·34	3·18
1891—95 . . .	13	14 000	4 157 316	460 664	116 914	11·20	2·83
1896—00 . . .	19	25 960	7 170 540	897 305	190 318	12·54	2·69
1901—05 . . .	20	26 076	7 077 150	1 022 928	103 350	14·49	1·44
1906—10 . . .	23	32 669	9 406 965	1 421 458	122 406	15·01	1·31
1910 (1910/11)	24	35 134	11 051 120	1 739 213	134 661	15·72	1·21
1911 (1911/12)	24	29 052	8 240 670	1 273 782	112 449	15·44	1·36
1912 (1912/13)	24	27 092	8 365 081	13 196 150	124 354	15·77	1·48

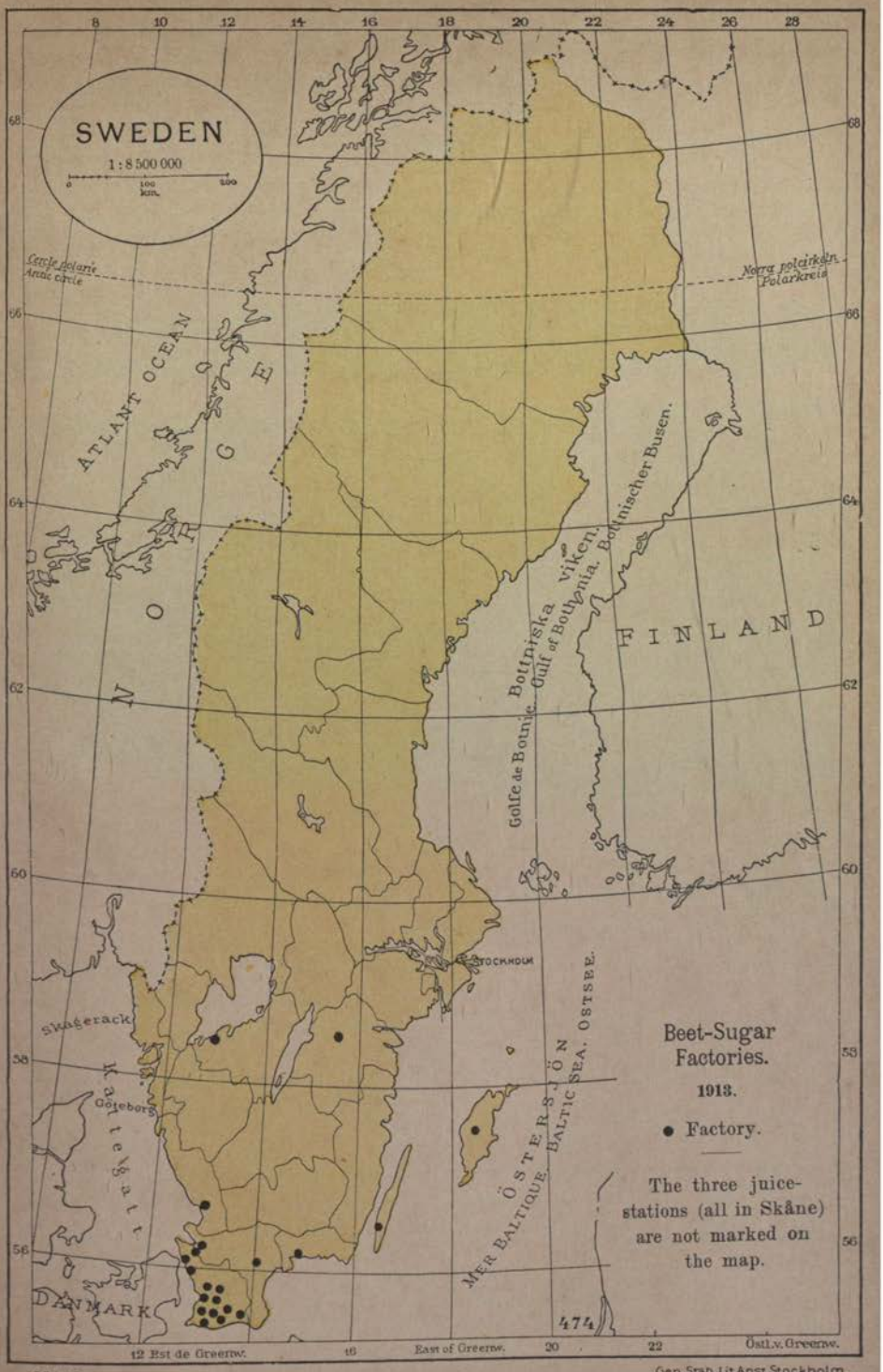
[1] The years given here, denote the *beet-seasons*, i. e., the manufacturing-years commencing during the years named and ending in the following ones. — [2] For the quinquennial periods 1876—95, the number of hectares are roughly estimated on the basis of a crop of 300 quintals per hectare. — [3] The figures for the quinquennial periods are averages of the percentages of yield for the respective years.

per diem, corresponding to about 140 tons of sugar. As a result, the *sugar-season*, which, according to law, is reckoned from September 1 to August 31, but which usually begins in the early days of October, has become still shorter, so that many factories nowadays have finished treating their beet about Christmas-time.

The *diffusion-method* is employed at all the factories; the beet is cut into slices, which are thoroughly steeped in warm water in diffusers. At the juice-stations, only extraction is carried out, the juice being afterwards conducted in underground pipes to the main factory.

The *seed* required for the cultivation of the beet is purchased abroad. The *crop of beet per hectare* varies between 270 and 320 quintals, the average being estimated at 295 quintals. By way of comparison it may be mentioned that the mean figure for Germany is 300 quintals, and that for France 270 quintals per hectare. The *yield of sugar per hectare* in Sweden is 45 q, in Germany 49 q and in France 33 q. The percentage of sugar in the beet during the last quinquennial period has averaged, in Sweden 15 %, in Germany 15·6 % and in France 13·3 %.

There has from early times been a customs duty on sugar in Sweden, the revenue yielded thereby being very considerable. Since July 1, 1873, the home production has paid **excise**. This has always been in the form of a beet-tax, based on an assumed fixed percentage of sugar in the beet; the amount depending on the current customs duty on unrefined sugar: to begin with, 20 % of this duty, later on, 40 %, and finally, 50 %. In order to determine the amount of the duty, the yield was first estimated to be 6·25 of the weight of the raw beet, but this was gradually increased to 12 %. In 1906, a consumption-tax was imposed on sugar, all sugar intended for consumption being subjected to a duty of an equal amount, irrespective of the quality of the goods; this tax was, at first, 13 öre per kilogram, but, from and inclusive of 1913, it was raised to 16 öre.



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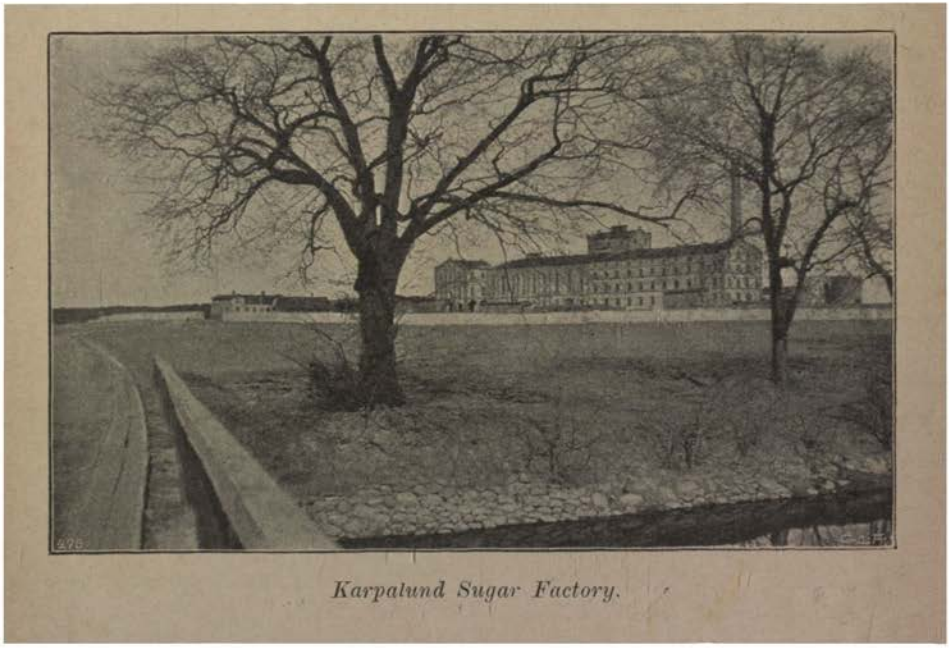
The **control,** when the old beet-tax was in force, was intended merely for ascertaining the weight of the beet employed. Since the introduction of the consumption-tax, it has been transformed into a complete control of the factories, so that no sugar can be taken from these places without the knowledge of the control-officials, who have to note the amount, etc., so removed. Every raw-sugar factory and sugar-refinery works is under the immediate supervision of a *First Controller,* who is assisted by a greater or lesser number of controllers. The chief control of the sugar manufacture is exercised by the *Royal Control Board.* The Royal Ordinance now in force respecting the taxation of sugar is dated October 11, 1907.



Karpalund Sugar Factory.

The principal *cause* of the rapid rise of the sugar industry in Sweden is to be found in the very considerable protective duty on the imported article. Even after the introduction of the consumption-tax, the three sugar-factories last erected, viz., in the island of Öland, and in the Läns of Östergötland and Västergötland, have enjoyed a certain reduction in the amount of the tax to be paid. The establishment of new factories, too, is facilitated by the regulation issued in 1893, that factories which are opened at a distance of more than 30 km from another factory which is in operation, will be considered as having a lesser yield per weight for the first five years, and so will pay a lower tax than older factories. Altogether, four factories have enjoyed such a reduction of tax.

Owing to the rise of a home-production of sugar, the *import* of this article, which was formerly very great, has almost entirely ceased, but the **consumption** has increased to such an extent that, nowadays, Sweden is among the number of the chief sugar-consuming countries of Europe, being surpassed only by England and Denmark.

The figures relative to this matter, both for Sweden and for other countries, are given on page I, 171.

The economic importance of the cultivation of the sugar-beet. Among the läns of Sweden, Skåne and, more especially, Malmöhus Län, are, very suitable for the cultivation of the beet, both as regards climate and the soil. Malmöhus Län, for example, yields about 71 % of the total quantity of beets obtained in Sweden for the sugar industry, and the beet-harvests there are, too, larger per hectare than in any other part of the country. The area devoted to the cultivation of the beet, consequently, amounts to 5 % of the total cultivated area of the län, while in Kristianstad Län the proportion is 1·2 % and in the island of Gottland, 2·8 %.

The cultivation of the beet is attended with considerable expense, necessitated by the great use of artificial manures, potash salts, and superphosphates. The successful cultivation of the beet requires not only a suitable climate and soil, but also a careful cultivation and manuring of the ground, and continual weeding during the season of growth. For this reason, the cultivation of the beet has a beneficial influence on the returns given by the other crops. As the chemical constituents of the sugar are obtained from the atmosphere alone, a sugar-harvest does not imply any loss of the mineral substances of the soil; these are found, on the other hand, in the beet-tops and beet-substance which are fed to the live stock, and the greater part of which is returned to the soil in the form of manure. Without exaggeration it may be said that the cultivation of the beet, thanks to its promotion of very thorough methods of work, the improved culture of the soil, and a harvest which is a more uniform and lucrative one than that of other forms of crops, has been, and still must be, considered as one of the most powerful factors in the improvement of agriculture in those tracts where the cultivation of the beet can be carried on with profit. Of the beets that are supplied to the factories, incomparably the greater part (during the season of 1912 13, some 96·6 % of the whole), was grown on land belonging to private landowners and not on that of the factories. In Malmöhus Län a good third part, and in Gottland more than half, of all the farmers tilling their own ground devoted themselves to the cultivation of the sugar-beet. The price paid for the beets by the factories consists, first, of a certain fixed rate — which, of late years, has been, for beets delivered before December 1, 2·10 kr. per quintal, and for delivery after December 1, 2·30 kr. per q — and also of an additional payment of 1 öre for each one-tenth percentage of sugar above 14 %. In this manner, the average price during 1912—13 has been as much as 2·65 kr. per quintal. With this price for beets, the gross returns per hectare for land under beets in Skåne, amounted the same year to 880 kr. The cost of cultivation can probably be estimated at about 300 kr., so that the net returns of beet-growing land in Skåne may be put at almost 580 kr. per hectare, an amount that is seldom equalled, we imagine, by any cultivated crop grown in Sweden.

The by-products from the raw-sugar factories are molasses and beet-pulp. The former is the final mother-liquor from the raw-sugar and forms a dark-brown, evil-smelling syrup which, in addition to water and salts contains about 50 % of sugar, however. The sugar in this molasses, which makes up about 3 % of the weight of the beets used, is, in some factories, precipitated by means of lime, and the sugar-lime thus obtained is afterwards treated in the factory, in order to extract the sugar from the mass. The molasses which is not treated in this way is either employed for the manufacture of spirits, or — and this is nowadays the usual plan — for cattle food, either alone, or mixed with husks, peat, fodder-cakes or beet-pulp.

Beet-pulp is the practically sugar-free beet-shreds which remain after diffusion, and constitutes from 40—50 % of the total weight of the beet; it forms a much esteemed cattle-fodder, which is usually sold at a very low price to the beet-growers.

According to a fairly new method of sugar-extraction — the so-called Steffen's boiling-method — a certain percentage of the sugar of the beet is allowed to remain in the beet-pulp, which, when dried, is termed sugar-shred and has a much greater value as a cattle fodder than ordinary beet-pulp. A comparison between the three food-stuffs shows that for one fodder-unit there is required 12·5 kg of fresh beet-pulp, 1·5 of dried pulp, 1·5 kg of molasses and 1.2 kg of dried sugar-shreds.

Sugar Refineries.

Some of the sugar refineries are directly connected with one or more raw sugar factories; all of them, as a rule, prepare only Swedish raw sugar; moreover, the improved technical processes of recent years have rendered it possible to rectify the beet juice *direct*, so that, after boiling, it yields a product equal in quality to refined sugar, termed "*melis*", or coarse loaf-sugar. Sugar of this kind is, however, manufactured at only one factory, namely at Hasslarp, which must therefore be regarded as both a raw sugar factory and a refinery. Table 75 shows the number of sugar refineries in Sweden and their output.

Out of these ten refineries there were eight situated in towns, notably at: Stockholm, Norrköping, Lidköping, Gothenburg, Hälsingborg, Landskrona, Lund, and Ystad; the remaining two are located in the country, in Skåne, namely at Hasslarp and Arlöv. With this year (1914) the refineries at Norrköping, Hälsingborg, Lund, and Hasslarp are stopped owing to changes in the customs tariffs (cf. below).

As the bulk of the sugar treated in the refineries nowadays is beet sugar, the **treacle** obtained can scarcely be used in cooking but must be utilized in the same way as white beet molasses. Only the treacle obtained in refining cane sugar is fit for human food, and treacle of this kind is, in fact, nowadays imported in great quantities, particularly from England and America. The ordinary qualities of sugar **used for consumption** are: *refined sugar* (*raffinad*) occurring in the form of loaf, lump, and granulated sugar, and *brown sugar* (*farina*), which

TABLE 75. *Sugar Refineries.*

Annually (Working year)	Number of refineries	Number of workmen	Refined Sugar		Treacle and molasses		Total thousands of kronor
			quintals	thousands of kronor	quintals	thousands of kronor	
1896—00 . .	9	2 499	801 613	42 005	46 174	288	42 293
1901—05 . .	9	2 641	967 125	50 009	54 628	302	50 311
1906—10 . .	10	3 077	1 187 300	61 445	65 441	419	61 864
1910 (1910/11)	10	2 759	1 298 085	69 954	88 947	588	70 542
1911 (1911/12)	10	2 682	1 231 630	72 475	100 865	1 171	73 646
1912 (1912/13)	10	.	1 347 916	.	115 375	.	.

Remark. Regarding working year, see explication Table 74.

resembles the "powdered sugar" (*pudersocker*) formerly in general use in Sweden, which consists of the raw sugar obtained in the preparation of the juice from the sugar cane.

The **duty** on sugar and treacle has been subject to considerable fluctuations. For many years prior to the introduction of the tax on consumption (*konsumtionsskatt*) the duty on refined sugar was 33 öre per kilogram, 23 1/2 öre for raw sugar, and 10 öre for treacle. As a result of the introduction of the tax on consumption, imported sugar was made liable to a tax as well as duty, and the aggregate amount of both was lowered from 33 to 30 öre for refined sugar. Out of this amount 17 öre was the duty and 13 öre the tax; for raw sugar the tax was the same as for refined, but the duty was only 11·75 öre per kilogram, no tax was levied on treacle, and the duty was 10 öre, as before. At the end of the year 1913, the tax on sugar was 16 öre and the duty on refined sugar 14 öre, on raw sugar 9 öre; treacle was exempt from the tax, but was subject to a duty of 10 öre. For 1914 onwards, the tax on sugar has been fixed at 16 öre, as before; the duty on refined sugar has been fixed at 11 öre, on raw sugar at 8 öre; treacle is still to be exempt from the tax, but the duty on it has been lowered to 5 öre a kilogram.

The tax on sugar during the last years has yielded the following amounts:

	Kr.
1908	14 469 097
1909	16 979 051
1910	17 458 297
1911	19 888 138
1912	17 962 981
1913	20 941 622

Sweets, Chocolate, and Coffee Substitutes.

Instead of coffee-beans, there are employed substitutes of different kinds, for instance: roasted grain and malt, with or without the addition of sugar or treacle, the roasted root of cichorium intybus, the roasted root of the dandelion, or roasted beet. Malmö is the chief centre of the manufacture of sweets, chocolate, and coffee substitutes, for, while the total value of the manufacture of these commodities in 1912, in the whole of Sweden, was 20 980 000 kronor, no less than 4 746 000 kronor was the value of the manufacture at Malmö alone. The total number of factories of this class in Sweden in 1912 was 109, employing 2 494 hands. Cocoa beans are *imported* mainly via Hamburg; crushed or powdered cocoa principally from Holland.

(By the way it may here be noted that the produce of the coffee-roasting works in Sweden during 1912 represented an output value of 5 776 000 kronor.)

Spirit Production.

For the production of spirits use is made principally of potatoes, although grain of all kinds is used as well and, also, although to a less extent, molasses and the sugar-beet. Of the ordinary cereals employed in the manufacture of spirits the first place is occupied by rye, barley, and meslin, the most important of them being barley, which, as a rule, is employed for the manufacture of malt. In years when the potato-crop was a poor one, maize used to be imported to supply the demands of the

distilleries, but since an extra duty of 10 öre was imposed on spirits manufactured from this cereal, the import for this purpose has diminished very considerably.

Regarding the employment of the potato for the purpose of manufacturing spirits, it may be mentioned that, as early as the middle of the 18th century, i. e., immediately after the introduction of the potato into Sweden, it was discovered that use could be made of it for distilling purposes, although the general use of the potato for the purpose in question probably did not occur before the beginning of the 19th century. As to the proportion of the potato-crop used for spirits, it may be stated that, in 1872, about 17 % of the total potato-crop of the country and 1·5 % of the grain-crop, found their way to the distilleries; in the manufacturing year 1912—13, there were used 235 165 quintals of grain of all kinds and 1 772 000 hectoliters of potatoes and, as the harvest in 1912 was estimated at 28 311 982 quintals of grain of all kinds and 28 175 600 hectoliters of potatoes, there was, consequently, employed in 1912—13 for the manufacture of spirits, only 0·83 % of the grain-harvest and 7·6 % of the potato-crop.

The spirit industry is becoming more and more an independent branch of industry, while, in earlier times, and even as late as the seventies, it was partly carried on as a branch of agriculture.

The number of the very small factories, which often confine themselves to the mashing of their own products, shows an absolute decrease. The average amount manufactured per distillery which, in the seventies, amounted to about 1 100 hectoliters, had, for the quinquennial period 1907—12, increased to 2 978 hl.

While, during the fifties all the provinces of the kingdom carried on the distilling of spirits, nowadays it is chiefly Skåne, Uppland, Blekinge, Gästrikland, and Halland that pursue the business. Of all the provinces, Skåne, in 1912—13, occupied the first place, having 72 % of all the distilleries and nearly 71 % of the total manufacture.

A special phase in the manufacture of spirits in Sweden was the experimental *distilling carried on with lichens*, which, on the proposal of *Professor Stenberg*, was carried on during the years 1867—77. Reindeer-moss contains a kind of cellulose which can be easily saccharified and be made to ferment alcoholically. The spirit manufactured from lichens had a peculiar flavour, which made it difficult to dispose of the article.

Sulphite Spirits. In spite of repeated attempts to employ wood-fibre — either in the form of sawdust or of peat — for the production of spirits, no very satisfactory result has been reached in the effort to obtain spirits from wood. On the other hand, two Swedish engineers, *J. A. Wallin* and *G. Ekström*, have succeeded in producing spirits from the waste-lye from the sulphite-cellulose factories. It was found that this waste-lye contains about 2 % of fermentable sugar, which can be made to ferment in the ordinary way by means of yeast. By this process there is obtained a spiritous solution which, it is true, contains only about 1 volume-percentage of alcohol, but by modern methods of distillation

it is easy to obtain from it a 95—96 % spirit. This manufacture has already gone on for some years and, in 1912, was pursued at three sulphite factories, viz., Skutskär in Uppland Län, Kvarnsveden in Kopparberg Län, and Bergvik in Gävleborg Län. The amount of sulphite spirit manufactured during 1912 amounted to 43 466 hl of 50 %-spirit, or about 10 % of the entire amount of spirits produced in the country. If a large number of the sulphite factories of Sweden produced sulphite spirits, however, the entire Swedish demand for spirits could be satisfied, for, after suitable rectification and re-distillation, sulphite spirit becomes quite palatable. At present, however, all such spirit is either methylated or exported.

Taxation. The distillation of spirits began in Sweden as early as the 15th century, but was not subjected to any control until the year 1638, when a levy on the manufacture was made for the first time, distillation for home consumption and that for sale being treated on different bases. From that time onwards, the distilling industry has had a very chequered career, having been altogether prohibited in years when the grain crop has been poor. In 1775, the distillation of spirits became a State monopoly, being carried on at Crown works. This state of things was, however, abolished in 1798, the license to distil having, as early as 1787, been leased to private persons.

The system adopted in some countries of fixing the amount of spirits allowed to be distilled, was once tried in Sweden too, for in 1799 the amount to be distilled was restricted in accordance with an assumed consumption of 11·8 liters per male and 5·9 liters per female of over 15 years of age, or an average of 6 liters per inhabitant of the whole population. (This quantity, which was thus at that time considered a reasonable and natural amount, is somewhat less than the lowest average in recent times — 6·1 liters per inhabitant in 1909.) As early as 1800, however, this arrangement was abandoned, and it was enacted that, in the rural districts, only farmers should be entitled to distil, the size allowed for the still being made proportionate to the area of the farm.

In the early part of last century, the *taxation* of spirits was made to depend on several different factors, viz., the cubic contents of the still, the assessed

TABLE 76. *Spirit Manufacture.*

Annually [1]	No. of factories	Steam engines		Raw materials employed			Spirits produced [2]	
		No.	HP.	Grain quintals	Root crops hl	Molasses quintals	Total hl	Per day hl
1871—75 . . .	429	.	.	399 835	2 634 259	9 130	**457 188**	11·74
1876—80 . . .	380	70	640	346 464	2 314 424	3 352	**445 019**	12·01
1881—85 . . .	293	93	833	292 505	1 839 717	5 333	**381 440**	13·99
1886—90 . . .	172	107	920	243 293	1 505 404	5 281	**336 430**	15·47
1891—95 . . .	138	113	1 016	292 878	1 240 212	16 152	**330 182**	17·14
1896—00 . . .	128	132	1 269	378 319	1 372 790	43 186	**421 190**	21·09
1901—05 . . .	133	157	1 667	271 449	1 816 873	32 060	**401 757**	20·90
1906—10 . . .	131	150	1 964	244 976	1 740 688	49 040	**427 595**	22·30
1910 (1910 11)	142	154	2 211	180 800	1 954 887	27 051	**407 160**	22·70
1911 (1911 12)	139	148	2 328	169 928	1 639 937	30 527	**402 152**	24·00
1912 (1912 13)	143	148	2 332	235 165	1 932 721	27 483	**453 301**	24·20

[1] Manufacturing-year, ending September 30. — [2] Reduced to 50 % alcohol.

value of the farm, and the amount of consumption. In 1855, the duty was increased considerably, and since that year a new system of taxation has been in force, a certain rate being fixed for a liter of spirits of 50 % volume percentage of alcohol at 15° C. Spirits with this proportion of alcohol are called *proof spirits*, and this is what is meant by "spirits" in all legal enactments and business transactions. The strength and temperature of spirits are determined by so-called *thermo-alcoholometers*, the reduction to the standard being effected by means of tables drawn up for the purpose. The excise, which in 1855, was 19·1 öre per liter, has since then been raised several times, and at present amounts to 65 öre per liter of spirits containing 50 % of alcohol. Of the total amount produced, 2 % is free from excise.

The total amounts raised by the taxation of spirits manufactured in the country are, in thousands of kronor (without reductions for *returns*, see below):

1904 . . . . . 24 487	1907 . . . . . 26 575	1910 . . . . . 24 414
1905 . . . . . 24 470	1908 . . . . . 24 459	1911 . . . . . 24 410
1906 . . . . . 27 156	1909 . . . . . 22 487	1912 . . . . . 24 212

Since 1884, the measurements of spirit for the purposes of excise have been made by a *Controlling Apparatus*, constructed by Gebrüder Siemens of Berlin; this apparatus not only registers the total number of liters of spirits that pass through it, but also the number of liters of the same spirits reduced to proof spirits; hence, the apparatus itself does the necessary reduction for purposes of excise. These apparatus are established by, and belong to, the State. At every distillery there must be a *Comptroller* present while the distilling is in progress, to watch the manufacture, take down the figures registered by the controlling apparatus, and see that sufficient spirits are kept in stock in a receptacle to which he has sole access, to cover the value af any unpaid excise. A *Chief Comptroller* exercises supervision over a fairly large number of distilleries; he alone has the right to open the controlling apparatus and he is required to keep himself informed of the way they work by testing them at frequent intervals. Final supervision of the manufacture of spirits in the whole country is exercised by the *Royal Control Board.* — The supervision by the "witnesses of the distillation", who were first appointed in 1855, was not continued after the introduction of the new system of excise, when the controlling apparatus was adopted.

The *law* now in force *regulating the manufacture of spirits* dates from July 13, 1887, but has subsequently been amended in some points. The distilling year runs nominally from 1 October to 30 September, but embraces in reality only the seven months, October to April; it is only those distilleries which also manufacture German yeast that are allowed to go on working during the months, May to September.

Information as to **legislation regarding the sale of spirits** is given in the article on the Temperance Question. In the same place (pp. I, 740 foll.), and also on p. I, 171, will be found data concerning the **consumption.** It may be here noted with regard to the latter that the import of *cognac* for the quinquennial periods 1871—1910, averaged 10 782, 15 745, 13 274, 9 910, 9 396, 11 303, 11 769, and 12 329 hectoliters annually, in 1911, 14 114 hl, in 1912, 14 319 hl and in 1913, 15 396 hl. The corresponding figures for *arrack* were 13 957, 10 252, 8 701, 8 232, 7 662, 8 618, 9 068, 7 570 hectoliters annually, and, in 1911, 7 969 hl. In 1912, the amount imported was 8 542 hl and in 1913, 8 836 hl. In the general figures for the consumption of spirits, these, as well as other varieties of imported spirits are included under the one general heading — always after reduction to 50 % alcoholvolume.

Rectification. By far the greater proportion of the spirits consumed in Sweden is rectified, either by means of charcoal filtration alone or by re-distillation, with which latter process fresh charcoal filtration is often combined.

The re-distillation of crude spirits is effected in special rectifiers, in which, fusel-oil and other impurities are separated from the spirits, and ethyl alcohol is obtained in a pure, or almost pure, state. Though several distilleries are now furnished with their own rectifiers, the rectifying of spirits is carried on principally as a special industry at factories where distilling is not done. The total number of the rectifying-works and the amount of rectified spirits produced is shown by the following table:

Annually	No. of rectifying-works	Amount of rectified spirits of 50 % alcohol-vol., hl
1901—05	20	403 660
1906—10	18	395 537
1910	17	332 055
1911	12	297 287
1912	9	257 872

Important rectifying-works are those at *Reymersholm*, near Stockholm, and those at *Gothenburg*, *Kristianstad*, *Karlshamn*, *Motala*, etc.

The largest rectifying-establishment that ever existed in Sweden was the one started at **Karlshamn** about 1885; its object was to refine crude spirits for subsequent exportation. Between 1885 and 1891, no less than 1 650 000 hectoliters of crude spirits of 50 % alcohol-volume were dealt with at this establishment.

The **methylation of spirit** for the purpose of rendering it unfit for consumption has been permitted since 1888; the restitution of excise follows. The methods of effecting it are different, according to the purpose for which the spirits are to be applied. The spirits that have been methylated by the so-called general methylating means (a mixture of ten parts of methylic alcohol to three parts of pyridine base), 13 cubic centimeters of which are added to each liter of spirits at proof, can be sold without let or hindrance. At the present time 64 öre per liter is returned of the spirit manufacturing excise paid. — The amount of spirits methylated has been, on an average per year, in hectoliters of 50 % strength:

1901—05: 31 465 hl; 1906—10: 47 972 hl; 1911: 61 812 hl; 1912: 69 000 hl; 1913: 57 280 hl, inclusive of fusel-oil and sulphite spirit. The methylation of spirits in 1912 and 1913 was for the following purposes:

	Year 1912	1913
for scientific purposes	184 hl	168 hl
» hospitals	564 »	561 »
» vinegar works	2 965 »	3 009 »
» chemical technical works	3 498 »	3 604 »
» gunpowder factories	3 211 »	2 998 »
» colour- and varnish factories	3 082 »	2 317 »
» free sale	55 502 »	44 623 »

Punch Manufactories. A kind of drink peculiar to Sweden is the so-called Swedish punch, a mixture of arrack, water, and sugar in varying proportions.

Annually	No. of breweries	Production hl	Export hl
1901—05	102	30 778	1 157
1906—10	97	27 006	1 373
1910	94	29 000	670
1911	93	29 391	657
1912	97	31 833	597

From 1904, inclusive, Swedish punch has been subject to a stamp-duty of 60 öre per liter.

Yeast.

The yeast required for the baking of bread was formerly obtained from the brewage of beer and small beer; it is now produced in *factories* established solely for the purpose, usually arranged like distilleries. While, however, the chief feature of an ordinary distillery is the production of alcohol, the main end of yeast-factories is the manufacture of yeast. It should be mentioned that it is possible, to some extent, to increase the yield of yeast at the expense of that of alcohol, and vice versâ. Thus, the infusion of air into the yeast-mash is an especially efficacious method of increasing the yield of yeast. Yeast prepared in this way goes by the name of *aerated yeast*, in distinction to that prepared without the infusion of air, which is called *surface yeast*. While of the latter from 25 to 30 kg of yeast is obtained from 100 liters of spirits of 50 % strength, the figure for ærated yeast can be raised to 100 kg, or more, per 100 liters of spirits. Most factories now employ both these methods. Aerated yeast is considered to be less effective in use than surface yeast.

The wholesale manufacture of yeast may be traced as far back as about 1850, but the industry was not subjected to legislation until 1871. In that year, the distilleries making German yeast were allowed to distil during the otherwise prohibited months May—September. The oldest known, and until 1873 the only, yeast factories in Sweden were those at Humlegården in Stockholm, and at Nacka in Stockholm Län. From 1885 onwards, the yield of yeast has been entered in the reports of the distilleries. In 1912—13, the total production of pure yeast amounted to 33 332 quintals, from 9 factories. — Pure unmixed yeast is sold only exceptionally; in general potatoflour is added to a weight of $^1/_4$—$^1/_2$ of that of the yeast.

Vinegar Factories.

The vinegar of commerce is, generally speaking, of two kinds: *spirit vinegar*, prepared from alcoholic fluids by the agency of the vinegar bacillus with an abundant supply of air, and *wood vinegar*, obtained by the dry distillation of wood, principally that of leaf-trees. While spirit vinegar, as a result of its method of preparation, is usually somewhat weak, containing less than 8 % of acetic acid, rectified wood vinegar is manufactured wholesale as ice-vinegar with a percentage of 100 of acetic acid, and must therefore be considerably diluted for use in the preparation of food. The vinegar most in favour is *wine vinegar*, imported principally from France. The manufacture of wood vinegar has considerably increased of late years, in consequence of the employment of the refuse from the saw-mills for this industry.

In 1912, there were manufactured at 11 factories a total amount of 5 422 000 kg of vinegar, calculated as containing 10 % of acetic acid. The chief spirit

vinegar factory is that of *Th. Winborg & Co.*, Stockholm, and the largest wood vinegar factory that of *W. Wendt*, Perstorp; these two turn out about 70 % of the total manufacture. In 1912, 55 960 kg of vinegar and acetic acid were *imported*, chiefly from France. The *exports* amounted to 132 035 kg, to England, Norway and the Argentine.

Wine and Syrup Factories.

The production of **syrup from the juice of berries** sweeted with sugar has long been a domestic industry in Sweden, all kinds of berries being made use of, especially raspberries, strawberries, gooseberries, currants, and certain kinds of cherries. Of late years, the wholesale manufacture, more particularly of variously flavoured lemonades, has been carried on, but, for economic reasons, the juices of the berries have been supplanted to a skadily increasing degree by a variety of artificial essences, and the sugar, or to some extent, by saccharine, whereby the quality of the beverages obtained has deteriorated. The manufacture of **berry-wine,** in the strict sense of the word, flourished about the middle of the seventies for a brief season, but not until twenty years later did it acquire any firm footing in the country; now it is carried on with greater success in consequence of its being based on more scientific principles, and of experience gained from other countries.

Many of the berries found in Sweden, both cultivated and wild, are suitable for the production of wine. The percentage of sugar in the berries is so low, however, that a considerable quantity of sugar has to be added, in order to obtain the necessary strength of alcohol. By employing the ferment of natural wines as a means of fermentation, something of their bouquet can be communicated to the berry-wines. Berry-wines can also be made to ferment of themselves, i. e., fermentation can be produced by means of species of ferments present in the berries, a wine of a special type being thus obtained, which can be of good quality, though it is strange to the palate.

In 1912, there existed 34 manufactories of berry-wines and syrups, the value of their annual production being estimated at 817 000 kronor. For the *consumption* of wine, cf. Temperance Question, Part I. The whole of the consumption there spoken of refers to that of imported wines.

Breweries.

Maltliquors have been produced in Sweden from time immemorial. At first, all the beer consumed was brewed at home, and it was only gradually that its manufacture developed into an industry. It was not before the introduction of the Bavarian method of decoction and bottom-fermentation, which was introduced into Sweden in the forties by Lieutenant F. Rosenquist af Åkershult and his German master-brewer, F. A. Beckmann, that brewing may be considered to have developed from a handicraft into a real industry. The brewery industry was placed on a still stronger basis in the eighties, when Emil Chr. Hansen made his revolutionizing discoveries concerning the pure cultivation of yest, which has been of immense importance for brewing technics.

In the main, the Swedish brewing industry has followed the development of the German brewing industry and, at present, may be considered

as standing on quite as high a plane as the latter. In the malt-houses, manual labour has in many places been replaced by machinery, pneumatic drum malthouses, and mechanical green malt turners. In the brewery, boiling with direct fire under the mash-tuns and brewing-pans has been replaced by steam-boiling; greater production has been obtained in the brewing by the employment of new mash-methods, the strainer-tanks have been improved and, in some places, replaced by filter-presses, while the amount of hops used has been reduced by the introduction of apparatus for the crushing and sorting of the hops. In most of the large breweries, cooling by means of natural ice has been superseded by the use of cooling machines. But while, in the brewing industry, Sweden, as we said above, has in the main followed the lead of Germany, in one point the former country has adopted its own method, viz., that for the distribution of the beer, the sale of the liquor from the barrel being replaced by the sale in bottles. This method of sale has, too, made it necessary to produce special apparatus for the cleansing, filling, and corking of the bottles. Special mention may be made of the apparatus invented by brewery-manager N. M. Simonsson, brewery-master K. Simonsson, brewery-manager S. Hydén, and engineer, J. K:son Lannmark. The disinfecting medium for pans, tubes and hoses, antiformin, invented by engineer V. Törnell and brewery-master A. Sjöö, is now very widely employed.

On account of the relatively limited market, there is not in Sweden any special brewery-machinery industry, the plant required being taken mostly from Germany. Wiklund's Mechanical Works, however, (which have now ceased to exist) constructed a number of brewery-plants in Sweden. It is also worthy of mention that cooling-machines are manufactured by the Munktell Mechanical Works, Eskilstuna, Tullgarn's Foundery and Mechanical Works, Uppsala and by the Ludvigsberg Workshops, Stockholm, the last-named factory also turning out breweries pumps. Of late years, too, the Swedish Metal Works, Västerås, has begun the manufacture of aluminium fermenting vessels.

Excise on malt liquors was imposed in Sweden as early as the close of the 16th century and, during the course of time, have been submitted to various modifications until, in the middle of the 19th century, it was altogether removed. In consequence of the ever-increasing demands made on the State treasury, however, a proposal was made at the beginning of the present century to reintroduce the taxation of malt-liquors. After lengthy committee-investigations, a Bill to this effect was brought before the Riksdag of 1903, and on June 17 of the same year, a law was issued concerning the manufacture and taxation of malt liquors. According to this law, the breweries are divided into two classes: those liable to the payment of excise and those exempt. The latter class of breweries may only manufacture small-beer (Sw. svagdricka), by which is meant a malt liquor which does not contain more than $2^1/_4$ % by volume of alcohol and is brewed with wort, which does not contain more than 6 % of extract content (Balling). The scale in the amount of the excise was fixed as follows: 2 öre for the first 30 000 kg of malt manufactured during the working year (Oct. —Sept.); 5 öre for the next 30 000 kg; 7 öre for the next 40 000 kg; 9 öre for the next 50 000 kg; 11 öre for the next 50 000 kg; and 12 öre for all additional malt, reckoned per kg. But in 1907 the lowest excise-rates were increased,

partly to cover the expenses of control over the smallest breweries and partly to prevent the establishment of new small breweries. These increased taxes were as follows: 4 öre for the first 50 000 kg; 7 öre for the next 50 000 kg; 10 öre for the next 50 000 kg, and 12 öre for all additional malt, reckoned per kg. In 1909 the excise-rates were again raised and, at present, amount to 17 öre for the first 100 000 kg; 20 öre for the next 100 000 kg, and 23 öre for all additional malt, reckoned per kg. In the first excise-year, 1903/04, the excise amounted to 2 845 922·19 kronor; after the second increase it amounted, for the year 1907/08, to 3 031 442·83 kronor, for the year 1911/12, after deduction of the restitution for small-beer malt (kr. 252 630·49) to 4 928 045·67 kr., and for the year 1912/1913, to 5 153 373·96 (— kr. 265 638·09) kronor respectively. According to the reports issued for the manufacturing year, October 1911—September 1912, by the Board of Control, the excise-duty amounted on an average to 19·9 öre and, for 1912/13, to 20·1 öre per kg of malt employed. The excise-rate, 23 öre per kg, is equal to not quite 2 öre pr 1/3 liter-bottle of lager-beer. On the occasion of the last increase of the excise, in 1909, restitution was permitted for the malt which is employed directly for the manufacture of small-beer at the breweries subject to the payment of excise. This restitution of duty was fixed at 14 öre per kg of malt, but was not to extend to more than 1/3 of the entire quantity of malt employed at the brewery during the manufacturing year. For the manufacture of malt-liquors liable to excise there may be employed nothing but barley-malt, hops, yeast, and water, and, on certain conditions, sugar-colouring. For porter, sugar and glucose may also be employed. Saccharine or other similar sweetening material may not be employed in the manufacture either of excisefree malt-liquors or of those that are free from duty. Breweries that are excise-free pay a certain small fee as a contribution to the expenses of control.

The sale of malt-liquors. The regulations issued in 1885, concerning the sale of wine and malt-liquors have, during the course of time, undergone various changes in order to promote the cause of temperance. Among other things, it was proposed that a fixed limit should be drawn between the malt liquors containing a large percentage of alcohol and those containing a very small percentage of spirit. After such a limit had been fixed by the regulation adopted in 1903, concerning the manufacture and taxation of malt liquors, the above alteration became possible. On June 9, 1905, there was issued a new regulation for the sale of wine and beer and also of manufactured alcohol-free liquors and small-beer. Alterations in some of the paragraphs of this regulation were made on June 10, 1910. By these regulations the Governors of the various läns of Sweden have been given extensive powers to limit the sale of malt liquors, and wide use has been made of the authority thus conferred.

Of the raw material employed, the barley is taken from Skåne, Gottland and Öland; it is only in unfavourable years that there is any import of this grain from Germany or Austria. On the other hand, all the hops employed are taken chiefly from Bohemia and Bavaria. Of late years, however, attempts have been made in Skåne to introduce the cultivation of hops, which, as a matter of fact, have been grown since very ancient times in Sweden.

All the statistics concerning the Swedish brewery industry are more or less incomplete. It is only after the introduction of the malt-tax that we obtain fully reliable statistics, which are given in the annual reports of the Board of Control. From these publications it is seen that the number of breweries subject to the payment of duty has declined from 223 in the taxation-year, October 1903—September 1904, to 190 during the taxation-year, October 1912—September 1913. The number of small-beer breweries has declined from 924 to 627 during the same period. In passing it may be mentioned that,

before the introduction of the malt-tax, the number of small-beer breweries was estimated to be about 400, instead of the more than 900 that they afterwards proved to be.

The report for the taxation-year 1912/13 shows that lager-beer forms the greater part of the liquor manufactured in the breweries paying excise, or 40·2 % of the whole, while pilsener-beer comes next, with 23·5 %. It is also seen that porter is manufactured chiefly in Gothenburg; lager-beer mostly in Southern and Western Sweden; pilsener-beer mostly in Stockholm and Norrland, lager- and pilsener-small-beer mostly in Stockholm and Gothenburg. Of the largest breweries subject to the payment of excise, 4 are situated in Stockholm and 2 in Gothenburg; altogether these used a total of 10 591 820 kg of malt, or 39·3 % of all the malt used in the country, and paid in excise 2 382 118·60 kronor, or 43·9 % of the entire excise paid in the country. Of the breweries subject to excise, the greater number (119) are situated in the towns, while 71 are situated in country districts. The strength of the wort amounted on an average to the following figures for:

Porter	17·5—19·0 % Balling
Lager-beer	11·0—12·5 » »
Pilsener-beer	10·5—11·5 » »
Lager- and pilsener-small-beer	8·0— 9·0 » »
Small-beer	4·0— 5·5 » »

The average price of barley amounted to about 16 kronor, and of hops to about 350 kronor per 100 kg. With these prices of barley and hops, it is estimated that the cost of ingredients for:

1 liter lager-beer amounts to	7·0 öre
1 » pilsener-beer amounts to	6·4 »
1 » lager- and pilsener small beer amounts to	5·0 »

Of the excise-free breweries, 534 used malt to a weight of not more than 20 000 kg, from which it may be seen that, on the whole, the small-beer industry is carried on as an inconsiderable handicraft.

The following *raw materials* have been used at the breweries liable to the payment of excise.

Taxation-year	Malt kg	Hops kg	Sugar-colouring kg	Sugar and syrup, kg
1903 (1903 04)	33 856 188	495 544	—	—
1904 (1904 05)	36 128 348	540 612	972	—
1905 (1905 06)	35 555 821	523 179	18 595	—
1906 (1906 07)	34 767 682	526 229	25 072	—
1907 (1907 08)	33 626 107	507 117	27 789	—
1908 (1908 09)	30 314 639	452 983	23 653	—
1909 (1909 10)	25 102 061	378 759	22 902	—
1910 (1910 11)	26 875 392	407 575	22 039	—
1911 (1911 12)	25 992 833	383 292	18 812	—
1912 (1912 13)	26 917 210	398 880	17 224	—
At the breweries exempt from excise:				
1903 (1903 04)	12 562 641	64 264	194 962	—
1904 (1904 05)	11 547 087	61 060	193 956	—
1905 (1905 06)	11 734 238	65 179	201 175	—
1906 (1906 07)	10 570 337	60 061	186 948	30 533
1907 (1907 08)	10 575 786	62 197	190 182	155 073
1908 (1908 09)	8 774 928	54 773	161 101	157 313
1909 (1909 10)	9 176 784	55 010	170 419	184 077
1910 (1910 11)	9 688 305	59 617	188 349	248 310
1911 (1911 12)	9 032 818	53 789	186 257	313 828
1912 (1912 13)	9 093 284	54 140	195 260	331 573

In general, 100 kg of barley give 78 kg of dried malt. The total amount of malt used during the taxation-year 1912/13 corresponded, accordingly, to about 46 000 000 kg of barley, or nearly 15 % of the total barley-crop of Sweden.

The *consumption of malt-liquors* is given below.

	Porter hl	Beer, all kinds, hl	Lager- and pilsener small beer, hl	Small beer hl
1903 (1903/04) . . .	44 030	1 182 990	177 858	1 770 680
1904 (1904/05) . . .	54 853	1 293 316	183 892	1 675 506
1905 (1905/06) . . .	58 829	1 245 653	190 633	1 797 904
1906 (1906/07) . . .	66 277	1 230 871	181 756	1 673 000
1907 (1907/08) . . .	60 386	1 161 002	207 084	1 690 125
1908 (1908/09) . . .	51 072	1 065 627	203 064	1 414 865
1909 (1909/10) . . .	33 627	871 443	148 601	1 527 491
1910 (1910/11) . . .	42 466	933 943	158 785	1 635 751
1911 (1911/12) . . .	41 944	904 689	146 845	1 564 838
1912 (1912/13) . . .	44 848	962 290	149 253	1 588 759

Malt-manufacture. The malt required for the brewing industry is, for the most part produced at the breweries themselves.

Malt extract and maltose-compounds were made at two factories in 1912, to a value of 29 500 kronor.

Mineral waters and cooling drinks.

Since the middle of the seventies there have existed firm foundations for the work carried on by these factories, thanks to *A. T. Almén's* valuable comparative researches regarding the character of natural and artificial mineral waters. A distinction must be made between *medicinal waters*, prepared from distilled water and the necessary chemically pure salts, by which they are given exactly the same composition as the corresponding natural waters, and *cooling drinks*, in the preparation of which less care is observed. It is not too much to say that the medicinal waters made at the best factories in Sweden are of the very finest quality, and that, owing to their uniformity of composition, they are even superior to the corresponding natural waters. The waters produced by the *Chemists' Mineral Waters Manufactory* (Sw. Apotekarnes Mineralvattenfabrik), in Stockholm, have gained considerable recognition.

There are, too, a large number of *natural springs* in Sweden, containing chalybeate waters of medicinal virtue, which are bottled and sold; such are the waters of Porla, Ronneby, and Karlstad. The two last-named are exceptionally rich in iron. There are also other springs which contain iodine, sodium carbonate, and sodium chloride, though only in small quantities.

Among cooling drinks may be reckoned *lemonade and fruit-drinks*, in the manufacture of which, however, artificial essences are now largely used, instead of natural fruit-juices.

In 1912, the total number of factories engaged in this industry amounted to 250, with a total production-value of 4 545 000 kronor. In addition, mineral waters and lemonades were manufactured at a number of country breweries.

Tobacco.

The earliest mention of tobacco in Sweden is in 1629. In 1640 the imports probably amounted to about 36 000 kg, and as early as 1641 the so-called "Söderkompaniet" (Southern Company) obtained the exclusive privilege of importing tobacco. In 1662 a kind of State-monopoly was introduced, so that the trade

in, and wholesale-purchase of, tobacco was, in future, to be administered by a Board appointed by the Government, the Board being empowered to lease out the exclusive right of importing tobacco and of erecting tobacco-factories everywhere in the country, with the exception of Estland and Livland, in consideration of an annual payment for the first 5 years of 120 000 copper "daler" and for the following 5-yearly periods of 170 000 copper "daler" (a "riksdaler" specie, corresponding to about 4 kronor of the present coinage, was, at the time in question, equal to 6 copper "daler"). At first the leasing of the monopoly seems to have acted satisfactorily, and the income received by the State appears to have been of some importance, but the Estate of Burghers complained at several Riksdags of the inconveniences caused to their body by the monopoly, and after the lease had been renewed in 1672 for the reduced sum of 100 000 copper "daler", the monopoly was entirely withdrawn in 1685 and the trade in tobacco made perfectly free. The income received by the State from tobacco has, since that time, chiefly consisted of the duties paid.

The usual method of consuming tobacco in the 17th century was by smoking in pipes, or by chewing.

In conformity with the endeavours made during the "Period of Liberty" to promote commercial industries, it was decided in 1748 that tobacco-plantations should be established near all towns, excepting those in the far north of the country; these plantations were placed under controllers, who had to see that a prescribed amount of Swedish tobacco was employed in every tobacco-factory. At an earlier date, for the purpose of preventing smuggling, of which complaints had often been made, it was prescribed that all tobacco, both native and foreign, should pay stamp-duty, and in 1748 the existing restrictions concerning the import of tobacco in the leaf were removed, and instead there was imposed, in addition to the ordinary duty, a "consumption-excise", or tax, which had to be paid by every man and woman that wished to use tobacco; this latter payment amounted to not more than one silver "daler" for "noblemen, clergymen, persons of quality, and the burghers in the large cities, for smoking-tobacco"; a smaller sum was demanded from those using snuff; soldiers and mariners in the service of the Crown were exempt from this payment. As a peculiarity it may be mentioned that Gustavus III, 1785—1786, had proposals drawn up for a State-monopoly of tobacco, which, however, in consequence of the opposition offered by the Riksdag and of the unfortunate experiences with regard to the Crown-distilleries, did not lead to the creation of the proposed monopoly but merely occasioned the State some considerable expense. From the beginning of the 19th century, the legislative measures concerning tobacco become fewer and merely concerned the amount of duty to be paid.

During the last few years, proposals have been worked out, partly for a manufacturing-duty, and partly for a State-monopoly of the goods manufactured from tobacco; this proposal, has been accepted by the Riksdag of 1914 which resolved to form a State-monopoly for tobacco and, in this connection, to control the cultivation of the tobacco-plant in Sweden. The monopoly can be made over by the State to some other body or individual; the cost-price of the manufactured article shall also include the duty to be paid in the following proportion of the price:

for cigars and cigar-cigarettes	15 %
» cigarettes	20 »
» cut tobacco	10 »
» spun-, pressed- and roll-tobacco	10 »
» snuff	15 »

The monopoly will come into force during 1915, on a day to be determined by the Government.

The import-duty, according to a resolution adopted by the Riksdag of 1914, amounts to the following sums per kilogram:

unmanufactured tobacco:	stalk	2	kr.
»	» leaf	2 à 3	»
manufactured	» cigars and cigar-cigarettes	7	»
»	» cigarettes	5	»
»	» cut	3·50	»
»	» other kinds	2·50	»

The tobacco factories in earlier times were chiefly situated in Stockholm (where the oldest establishment seems to have been founded in 1660), Norrköping, Gävle, and Kristianstad, but they have gradually spread to other towns and even to country districts. Of the 102 tobacco-factories in Sweden existing in 1912, 41 were in Stockholm, Gothenburg and Malmö, the value of the manufactured tobacco turned out by them amounted to a total of more than 67 % of the tobacco-manufactures of the country, 23 028 000 kr. Of the 102 factories, 82 were situated in the towns, and 20 in the country districts, chiefly in Skåne. The *cultivation* of tobacco, on a scale, worth mentioning, began about 1750, and in this industry, as in so many others, it was the great *Jonas Alströmer* that led the way. About 1770, the tobacco-harvest was estimated at 7 000 quintals, or almost as much as in our own times, for during the last 25 years the harvests show the following average figures:

Annually	Quintals	Annually	Quintals	Annually	Quintals
1886—90	10 405	1896—00	7 745	1906—10	9 894
1891—95	10 837	1901—05	10 450	1911	7 064

The area devoted to the growth of tobacco varies very much. For example, during the years 1897—1902, it varied between 365 hectares in 1902 and 482 hectares in 1901. At the present time, more than half of all the tobacco grown in Sweden is obtained from Kristianstad Län, where the tract of country round Åhus comprises by far the largest area devoted to this plant, although it is divided into a very large number of small plots. Formerly, much tobacco was grown in and around a number of towns, Stockholm especially. The average crop per hectare amounted in 1902 to 16 quintals of air-dried, unsweated tobacco;

TABLE 77. *Survey of the Tobacco-industry in Sweden.*

Annually	Factories	Production. In Quintals				Total production		Imports. Quintals	
		Cigars	Packet tobacco	Roll and cake tobacco	Snuff	Quintals	Value. Thousands of kronor	Leaf tobacco	Manufac. tobacco
1871—75	103	4 698	4 159	8 737	28 423	46 017	8 872	31 915	562
1876—80	107	5 512	4 825	9 327	32 191	51 855	10 778	35 125	1 242
1881—85	105	4 229	4 780	10 007	32 812	51 828	10 831	32 784	1 022
1886—90	92	2 916	2 780	11 868	35 084	52 648	10 316	34 206	1 071
1891—95	91	5 011	3 797	10 791	39 331	58 930	11 994	34 029	1 064
1896—00	96	6 940	4 058	8 821	45 847	65 666	15 045	36 604	1 737
1901—05	113	8 677	3 924	8 105	52 418	73 124	17 202	40 361	2 381
1906—10	108	10 879	3 593	6 344	59 811	80 626	21 136	41 108	3 713
1910	107	11 695	3 855	5 907	62 211	83 668	22 325	42 811	4 569
1911	108	11 127	3 627	5 679	61 291	81 724	22 218	45 605	4 804
1912	102	11 186	3 380	5 559	62 939	82 844	23 028	44 966	5 574

in the Åhus district the average crop, in years that give average returns, is estimated at about 20—25 quintals, both of better and inferior quality.

As Swedish tobacco possesses a peculiar aroma, different from that of superior foreign brands, it cannot be mixed with the latter to any very great extent. Such mixture occurs only for the cheaper varieties of cigars and snuff.

Tobacco is nowadays consumed in many different forms, being consumed in the form of pipe-tobacco, cigars, cigar-cigarettes or cigarettes, and also as chewing-tobacco and snuff. *Smoking-tobacco* occurs either cut or in complete leaves; *chewing-tobacco* is usually twisted and sold in rolls. Of *snuff*, the greater quantity is stated to be used for chewing.

As in so many other industries, a number of factories in the tobacco-industry have lately (1912) united to form one large company.

The *imported* tobacco comes mostly from America, via Bremen, and is partly of the heavier kind, such as Kentucky tobacco, and partly of the lighter sorts, such as Virginia tobacco.

The total number of *hands* engaged at the Swedish tobacco-factories amounted in 1912 to 4 704, of which number 3 215 were women.

Other Manufactures.

With regard to other industries for the production of articles of food and consumption, the following details may be given, including the number of employees and the total value of the productions for the year 1912.

	Factories	Employees	Value, kr.
Bakeries	97	2 411	21 202 000
Pig slaughter houses	12	126	11 244 000
Factories for porkbutchers' commodities	56	562	10 713 000
Fish-pickling businesses	40	638	2 780 000
Preserve factories	13	129	1 080 000

With regard to these figures, it should not be forgotten that only the few establishments are here included which can be reckoned as belonging to the greater industries. The greater part of the production in these branches is, of course, carried on on a smaller scale and comes within the category of domestic industries.

2. TEXTILE AND CLOTHING INDUSTRY.

This group, which, nowadays, as regards the value of its productions, is the most important of Swedish manufacturing industries, on account of the great number of neccessaries it comprises, is, in the official statistics, divided in the following way (1912):

	Factories	Workmen	Production, kr.
Yarn and thread, etc.[1]	189	11 371	74 680 200
Textile fabrics	156	16 497	89 614 300
Calendered fabrics	116	2 161	5 608 600
Articles of clothing, etc.[2]	269	13 578	51 687 400
Total	**730**	**43 607**	**221 590 500**

[1] Including rope work, etc. — [2] All kinds of manufactures of spinning materials, such as textile fabrics, ribbons, embroideries, hats and bonnets, clothes, etc.

Although the home production is so considerable, this group of manufactures is one of those that figure most in Swedish imports, which testifies to the fact that the Swedish textile industry is far from sufficient to supply the country's own needs. During the last few years, however, it has increased in a most remarkable way, above all as regards the manufacture of yarn and articles of clothing, the value of which has multiplied many times during the last ten years. From Table 78 appears that the imports of articles of this class — raw materials as well as manufactured goods — during 1871—80 amounted to 65 million krönor per annum; during 1881—90, to 85 millions; during the years 1891—1900 to 84 million kronor; from 1901—1910 to 103 millions, and in 1912 to 130 million kronor. In comparison with the total imports, a decrease is noticeable, however, the imports of this group of manufactures in the beginning of the decade 1871—80 forming 27 % of our entire imports, but nowadays only about 17 %.

One favourable circumstance is that the *import of yarn and manufactured goods* has not undergone any increase worth mentioning during the last few years, while, on the other hand, there has been an increase in the import of *raw materials*. This points to the fact that the Swedish textile industry is in a most flourishing condition, which is the case especially with regard to the cotton industry. For example, we find

TABLE 78. *Imports and Exports of Textile raw Materials, Manufactures, and Articles of Clothing.*

Annually	*Imports.* Value in thousands of kronor				*Exports.* Value in thousands of kronor				In per cent of the total [3]	
	Raw materials	Yarn and thread etc.[1]	Manufactures[2]	Total	Raw materials	Yarn and thread, etc.[1]	Manufactures[2]	Total	Imports	Exports
1871—75 . .	20 556	8 635	37 574	**66 767**	307	178	2 009	**2 494**	27·10	1·22
1876—80 . .	16 842	8 202	38 427	**63 471**	294	286	2 766	**3 346**	23·63	1·60
1881—85 . .	20 433	9 375	51 394	**81 202**	394	506	4 182	**5 082**	25·57	2·09
1886—90 . .	23 864	10 356	55 520	**89 740**	366	1 043	5 594	**7 003**	26·75	2·57
1891—95 . .	20 592	11 936	48 414	**80 942**	122	1 052	7 879	**9 053**	23·02	2·85
1896—00 . .	24 666	17 419	44 505	**86 590**	176	1 080	4 462	**5 718**	19·14	1·59
1901—05 . .	35 353	14 375	40 121	**89 849**	455	1 350	2 037	**3 842**	16·84	0·94
1906—10 . .	47 323	13 908	55 129	**116 360**	804	1 434	2 367	**4 605**	18·05	0·89
1908	43 335	10 847	51 297	**105 479**	707	1 286	2 580	**4 573**	17·32	0·95
1909	40 687	12 324	53 212	**106 223**	983	1 311	2 187	**4 481**	17·22	0·95
1910	51 069	15 700	59 494	**126 263**	992	1 245	2 680	**4 917**	18·80	0·83
1911	48 622	15 305	63 167	**127 094**	878	1 547	2 723	**5 148**	18·24	0·78
1912	57 025	18 756	53 997	**129 778**	2 297	3 043	4 556	**9 896**	16·54	1·30

Note. Concerning the import- and export tables it should be remarked, that the year 1912 is not quite comparable in every respect with earlier years, on account of alterations in the official grouping of the wares.

[1] Including rope-work, etc. — [2] All kinds of manufactures of spinning materials, such as textile fabrics, ribbons, embroideries, hats, bonnets and clothes, etc., and for the years before 1907, for artificial flowers too. — [3] The last two columns show the imports and exports of textile fabrics in % of the total import- and export values of all kinds of goods in the kingdom.

that the weaving mills have considerably increased their output, especially of pattern fabrics and stuffs of better quality.

The exports of textile manufactures go principally to Norway. After the revocation, in 1897, of the Special Commercial Treaty (mellanrikslagen) between Sweden and Norway it has considerably diminished — though not in the proportion shown by Table 78. As we shall several times have occasion to remind our readers, the Swedish figures for the exports to Norway are, in fact, very *incomplete* and especially so after 1897.

The Swedes have, from time immemorial, displayed considerable liking and natural taste for the textile arts. But even though Swedish native textile art goes back to remote ages, and the textile manufacturing industry to the days of Gustavus II Adolphus, nevertheless, this manufacture was always intended primarily to supply the actual necessities of the country. One consequence of this is that the fabrics produced in this branch of industry are generally of a simpler sort, suitable for use by the people at large. The home market is not extensive enough to repay the expense connected with the manufacture of new or special products. And if the native manufacturer is, with any hope of success, to compete with the foreigner who is flooding the Swedish market with his products, he must avoid embarking on this too precarious venture, but confine himself to the simpler and cheaper goods already known to his customers.

There has been a remarkable change in this respect, however, during the last few years, more attention having been devoted to the manufacture of the better qualities of cloth.

The first place in the textile industry of Sweden — chiefly, however, in the cotton-industry — is occupied by the Län of Älvsborg, with a manufacture-value of about one-fourth of that of the entire country, the town of Borås and the neighbourhood being the centre of the business. The chief seat of the Swedish woollen industry, on the other hand, is in Östergötland Län, the principal centre being Norrköping.

For promoting skill in the textile industry, there are two **Weaving schools,** originally started by private persons, viz., *John Lenning's Weaving School* at Norrköping, and the *Borås Technical Weaving School.* The former was founded in 1879, by means of a donation of 300 000 kronor by a manufacturer, named John Lenning. This school has a higher course for training manufacturers, foremen, designers, etc., and a lower one (chiefly with evening lectures) for workmen and apprentices in the trade. The weaving school in Borås was originally a private establishment founded by a teacher of weaving, named *S. F. Krebs,* but, in 1866, at the suggestion of the Board of the Borås Technical School, it became a public institution, and, at the present time, receives a grant from the State of 4 800 kronor per annum and 2 900 kronor annually from the Älvsborg Län County Council. — Besides these, there are, in other parts of the country, a large number of weaving-schools for promoting *domestic industry* amongst which may be especially mentioned the Weaving School of the society called "Friends of Art Needle-work" in Stockholm; the Tullgarn Weaving School, established and supported by H. M., the Queen; Miss N. v. Engeström's School in Örebro; Johanna Brunsson's Practical Art Weaving School in Stockholm; Thora Kulle's in Lund, etc.

Woollen Industry.

The real improvement in Sweden's native breed of sheep did not begin until after 1715, when *Jonas Alströmer,* rightly called "the father of

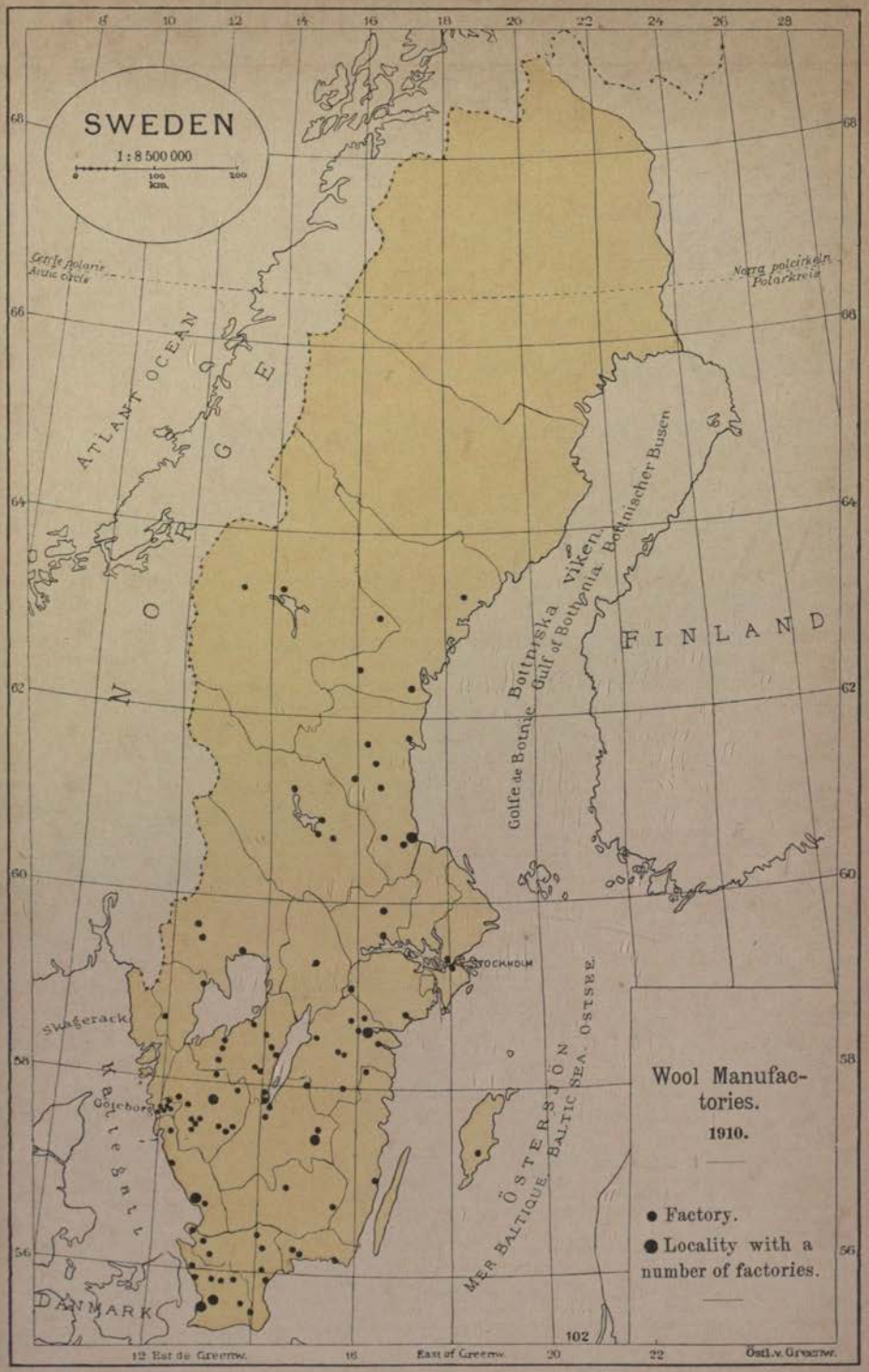
Swedish industries", began his experiments in naturalizing foreign breeds of fine-wolled sheed, particularly the Spanish merinos.

These experiments apparently succeeded in the beginning, so that in 1764 there were in Sweden no less than 89 000 sheep of a pure, and 23 000 of a mixed merino breed. Great efforts were made by the Government to increase the stock of fine-woolled sheep. Prizes were given for wool; sheep-breeding farms were established; the so-called "Wool Discount" was introduced for granting loans to tradesmen in a small way of business for the purchase of native wool; in addition to which, wool-stores and wool-markets were established to facilitate its sale. Notwithstanding all these efforts, this breed of sheep has declined more and more, and at present hardly numbers 1 000. Several causes have contributed to this state of things, especially the difficulty in disposing of native merino wool to the manufacturers, who preferred the foreign kind as the former was very unequal in quality. The thoroughbreds imported at different times are also said not always to have been of the best race. Attempts to naturalize fine-woolled Angora goats turned out even a greater failure.

During the whole of this time — the Alströmer period — attention had been exclusively directed to the production in this country of *fine* wool or merino wool. When, however, after nearly a century of incessant attempts to promote the use of native wool in Swedish mills, these efforts had proved unsuccessful, then people began to see that even the coarser wool might be worth attention.

The next phase in the history of Swedish wool production, beginning with the nineteenth century, thus gave a new direction to this industry. Instead of, as before, chiefly regarding the fineness or quality of the wool, stress was now laid on increasing the quantity of coarse kinds of wool. And these attempts, in spite of many unfavourable circumstances, have proved profitable. Besides the unimproved, Swedish country sheep — the so-called peasant breed — the wool of which is uneven and somewhat coarse, chiefly suited for coarse textures (homespun or rough clothing), there are at present the following breeds, mostly imported from England, viz., Southdown, Shropshiredown, and Oxfordshiredown (especially in Södermanland, Skåne, and Halland); further, Leicester, Dishley, and Cheviot — the latter especially in Gottland and Norrbotten, — and, finally, the merino breeds (Östergötland, Södermanland). According to later observations it seems as if the Cheviot breed would still further increase in Gottland — where, apart from other favourable circumstances, its propagation has been encouraged by the operations of the old Roma State sheep-farm — and also as if the long-haired breeds (Oxfordshiredown etc.) would steadily increase and supplant the white-faced ones (Leicester, Cotsewold, etc.). Among native breeds, the Gottland sheep on the island of Fårön have begun to attract notice, as a breed in many respects suited to Sweden. One circumstance which speaks for the improvement of the native breed by crossing with English and not merino sheep is that the latter do not make good mutton.

The stock of native sheep, has nevertheless decreased more and more. Whilst in 1870 it amounted to 1 600 000 there are now only about 900 000, of which more than 100 000 in the Län of Jönköping. The cause of this decline must be sought for partly in the circumstances that the native wool, from its unevenness and the difficulty in obtaining it in larger parcels, is not readily bought by manufacturers, and that the wool-market is flooded with foreign and artificial wool (shoddy, mungo, extract, etc.), and partly in the circumstance that the farmers have inclosed larger spaces for dairy purposes, in addition to which, the lack of fodder, which often occurs in certain parts of the kingdom, results in the slaughtering of the sheep. For the encouragement of the breeding of native


SWEDEN
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Cercle polaire
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FINLAND
Bottniska viken
Gulf of Bothnia
Bottnischer Busen
Golfe de Botnie
STOCKHOLM
Skagerack
Göteborg
Kattegatt
DANMARK
ÖSTERSJÖN
MER BALTIQUE
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OSTSEE
Wool Manufactories.
1910.
Factory.
Locality with a number of factories.
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East of Greenw.
Östl. v. Greenw.
102
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Gen. Stab. Lit. Anst. Stockholm

TABLE 79. *Imports and Exports of Wool and Woollen Stuffs.*
In quintals.

Annually	Wool		Woollen yarn, undyed		Woollen yarn, dyed		Woollen cloths	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
1861—65 . . .	12 875	110	693	—	1 118	2	4 934	36
1866—70 . . .	13 750	202	626	3	1 322	1	5 212	246
1871—75 . . .	17 521	318	1 427	4	3 420	6	15 998	460
1876—80 . . .	13 729	146	1 524	2	4 072	8	16 838	894
1881—85 . . .	18 429	271	3 910	3	5 435	27	22 442	1 023
1886—90 . . .	21 790	286	8 950	45	5 752	460	23 062	1 586
1891—95 . . .	24 001	252	14 263	53	4 528	777	25 776	2 603
1896—00 . . .	33 602	491	21 468	116	5 188	1 076	22 399	2 385
1901—05 . . .	44 719	1 244	14 257	113	4 695	1 212	15 424	992
1906—10 . . .	52 398	778	13 031	394	5 040	1 253	16 103	916
1908	55 877	323	10 695	366	4 788	1 256	14 842	948
1909	51 627	948	12 971	297	4 390	1 115	14 656	838
1910	49 749	638	17 617	308	5 881	1 059	15 762	1 081
1911	50 674	604	15 826	273	5 549	1 194	16 031	1 197
1912	66 237	618	14 502	479	5 240	1 974	12 360	2 006

sheep, the State has in recent times appointed a specialist to give *instruction in wool-culture and sheep-farming.*

The wool imported, which is admitted free of duty, is brought for the most part by way of England and Germany, but also via Denmark, Belgium, and France. The superior sorts of carding-wool come from the Cape, Buenos Ayres, Australia, and Silesia.

A summary of the **production value** of the Swedish wool industry is given in Table 80. The table also gives the values of the *imports* (for the

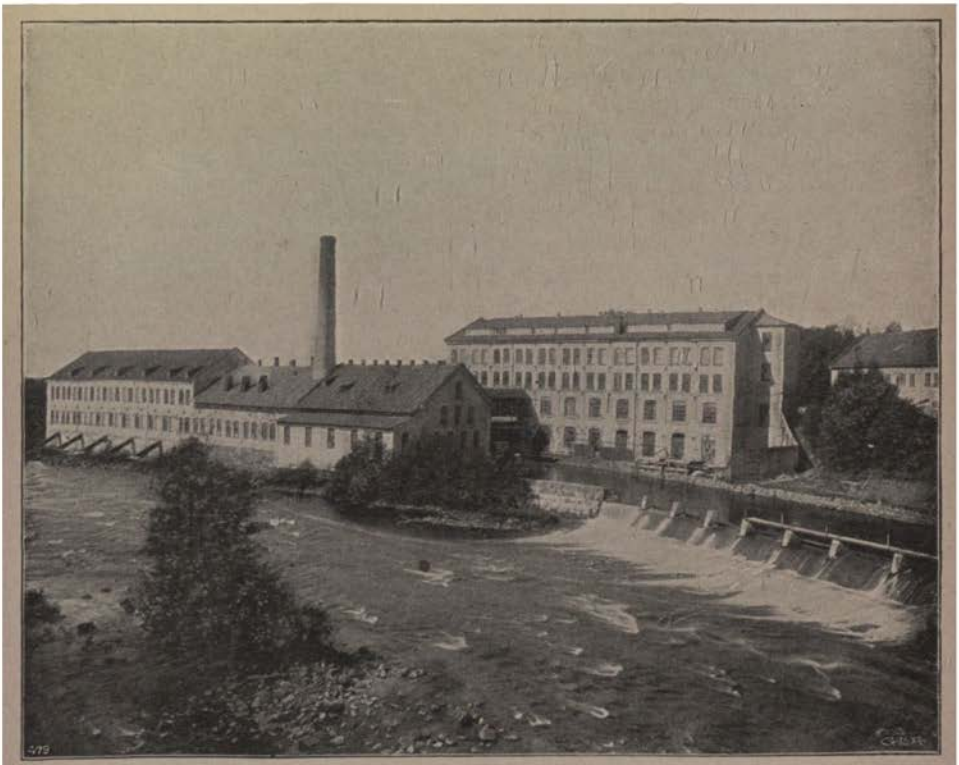
TABLE 80. *Survey of Manufactures and Imports in the Woollen industry.*

Annually	*Spinneries.* Manufactures[1]		*Cloth-factories.* Manufactures. Value, in thousands of kronor	*Imports.* Value in thousands of Kron				
	Quintals	Value, in thousands of kronor		Wool	Yarn	Textile fabrics		Textile fabrics, %
1 66—70 . . .	668	92	9 569	.	.	5 194	.	.
1871—75 . . .	1 642	253	13 613	6 320	3 692	16 118	**26 130**	61·7
1876—80 . . .	3 197	711	10 743	4 486	3 032	16 924	**24 442**	69·2
1881—85 . . .	6 543	1 288	11 880	5 428	3 479	21 804	**30 711**	71·0
1886—90 . . .	16 136	3 167	12 816	6 874	5 179	22 373	**34 426**	65·0
1891—95 . . .	22 937	4 276	19 389	4 820	6 511	20 227	**31 558**	64·1
1896—00 . . .	65 064	16 862	26 765	7 332	10 503	15 800	**33 635**	47·0
1901—05 . . .	82 190	22 849	33 277	12 301	8 623	11 712	**32 636**	35 9
1906—10 . . .	96 892	28 727	42 276	15 406	7 316	11 897	**34 619**	34·4
1908	96 010	27 682	42 043	13 865	5 259	10 925	**30 049**	36·4
1909	90 675	26 682	39 273	13 775	6 271	10 887	**30 933**	35·2
1910	103 954	30 359	47 460	13 608	9 154	11 765	**34 527**	34·1
1911	102 472	29 294	44 600	13 289	8 323	11 769	**33 381**	35·3
1912	109 613	32 675	44 804	18 438	9 899	9 928	**38 265**	25·9

[1] The figures for former years are incomplete. Altered statistics from 1896.

quantities, see Table 79). On the whole, all the figures bear witness to a considerable increase of the manufacture of late, whilst the imports nowadays remain almost stationary. A pleasing fact is that the imports of woollen textiles have diminished, both relatively and absolutely; in 1881—85 about 71 % of the entire import were textiles; in 1912 this figure had fallen to about 26 %. The value of the imported woollen woven goods has now fallen from 25 million kronor in 1890 and 13 million kronor in 1900, to about 10 million kronor at present, while, at the same time, the value of the goods manufactured in Sweden during the last 10 years has almost doubled, having risen from 29 million kronor in 1900 to 47 million kronor in 1910. During the same period the manufactured value of woollen yarn has increased from 20 million kronor to 30 million kronor. The woollen goods imported come for the most part from Germany.

The wool manufactories of Sweden are to a large extent situated in Norrköping, where in 1850 there were no less than 122 cloth manufactories, but now, since the smaller ones have for the most part disappeared, only about 20, amongst which may be mentioned the *Drag, Brück, Wahren* and *Ström*, the three last named being now merged in the *Aktiebolaget de förenade yllefabrikerna*. Norrköping, "the Manchester of Sweden", has a particularly advantageous situation for this industry, having



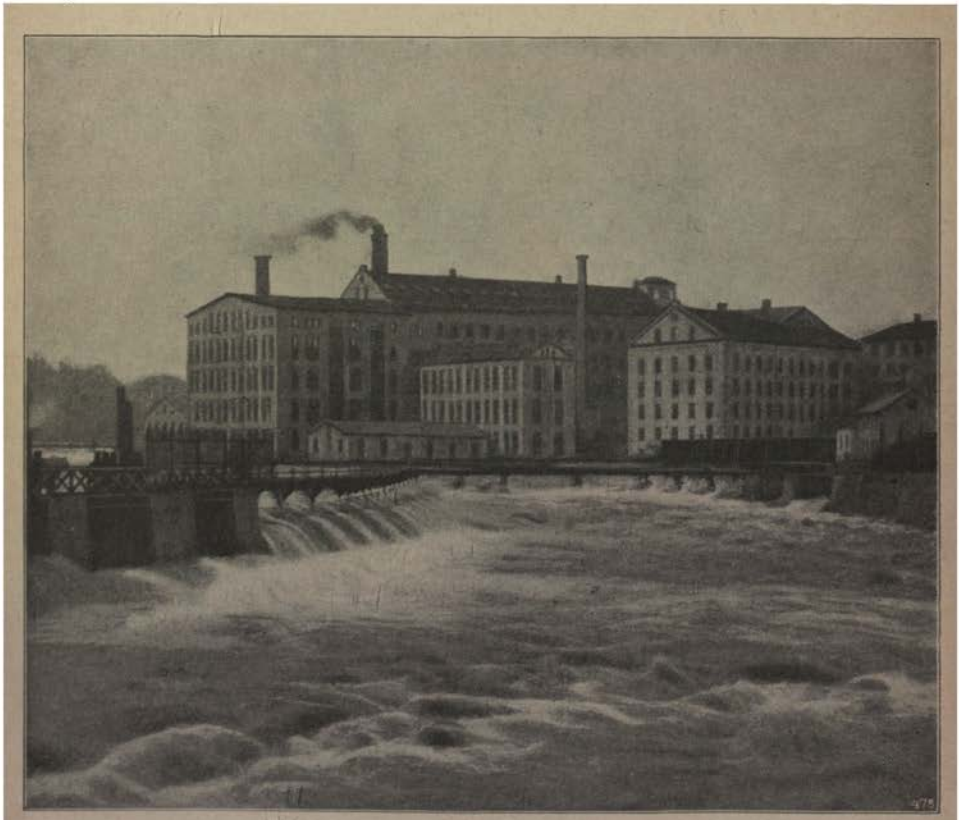
Slottsmöllan Cloth-Mills (Wallbergs fabriksaktiebolag), Halmstad.

John Lenning.

abundant supply of water-power. For more than 200 years this town has been the centre of a flourishing textile industry, which was founded by Gustavus Adolphus. *Drag's* cloth-mills, established in 1810, have a great and well-deserved reputation for the excellence of their productions. After being turned into a limited liability Company in 1854, it became, under the direction of *John Lenning* (1819—79), the principal business of its kind in the country. A prominent business man and manufacturer and a great friend of the workmen, whose conditions he always endeavoured to improve, he donated at his death nearly the whole of his fortune to the town of Norrköping for public utilitarian purposes. This donation led, among other things, to the erection of the school of weaving in the town in question, which has been called by his name. (Cf. above.) Among the other larger wool manufactories may be mentioned the *Malmö yllefabrik, Göteborgs kamgarnsspinneriaktiebolag, Aktiebolaget Fors ullspinneri* in Nyköping, *Aktiebolaget Skånska yllefabriken* in Kristianstad, the *Sahlström fabrik* at Jönköping, *Wallbergs fabriksaktiebolag* in Halmstad, *C. O. Borgs söner* in Lund, and several factories in Borås, among which there are a wool and vigogne spinning-mill, and also

a worsted spinning-mill. There are also a number of spinning-mills in the rural districts, mainly for the treatment of native wool.

The number of spindles in the Swedish woollen industry amounted in 1912 to about 240 000 and the number of looms to 5 000. Among the most remarkable features of this industry in later times may be mentioned the growing employment of ring-spindle looms in the carding-wool industry, although mostly for the coarser yarns; further, the so-called dyeing of felling — previously introduced into the cotton industry, and, finally, the general introduction into the mills, of the two-loom system and quick-working looms, this making possible an essential increase in the output.



Drag Cloth-Mills, Norrköping.

While the larger factories have developed more and more, even if partly at the expense of the smaller ones, the value of the output has, during the last thirty or forty years, increased many times over. The manufacture of fine cloth for wearing apparel seems to be gradually decreasing, while the contrary is the case with regard to the coarser kinds. The *Drag* Company's manufactures of cloth for uniforms, suits, and over-

coats, of black cloths, satins, and twills, are well-known and, in respect to quality, can compete with the best foreign makes. Coarser cloths, such as duffel, baize, corduroy, and frieze, etc., are manufactured on a large scale in Sweden, as well as shawls, rugs, blankets, flannels, and Cotton warp stuffs (thread-cloth, buckskin, velvets, etc.). Latterly, combing-wool cloths for ladies have begun to be manufactured by *Aktiebolaget Merinos* and *Aktiebolaget Borås klädningstygsfabrik* in Borås, such as cheviots, thibet, paramatta, etc., both pure wool and linseys, twills, black and fancy cloth for ladies' dresses. *Wallbergs fabriksaktiebolag* at Slottsmöllan in Halmstad, occupies a conspicuous place among the makers of felt. There is manufactured there woven felt (for paper- and wood-pulp machines, filtering, etc.) as well as pressed (felt squares; pipes; felt for isolating purposes). Even pattern-weavings with Jacquard wool are produced at several factories, particularly damask for furniture and carpets, both the simpler kinds (stair-carpets) and so-called Kidderminster and Axminster carpets. The *Stockinet* manufacture, i. e., machine-made knitted stuffs, is of great importance. This manufacture, the production value of which has increased many times over during the last few years, uses both pure wool and wool mixed with cotton (vigogne thread) and also old carded stuffs. — An important economic fusion in this domain is the *Aktiebolaget Sveriges förenade trikåfabriker*, Borås.

Of the **wool consumed** by wool-factories, amounting to about 6 or 7 million kg per annum, about 45 % is imported, 10 % or 15 % consists of native wool, and the remaining 40 or 45 % of artificial wool (carded worsted, shoddy, mungo, extract, or the like). Among the imported wools may be noticed also the so-called "noils", or the waste-wool left in the process of wool-combing, which is mixed with other wool or cotton. The import of worsteds amounts to nearly half of the entire consumption of such textile fabrics in Sweden — during the last few years, however, it has been much less.

Quite an important industry has arisen in recent years in Sweden, as well as abroad, by the use of *old wool stuffs as raw material*, either alone or with an admixture of wool or cotton. By tearing up unfulled stuffs, worsted, etc., a better and longer haired material ("shoddy") is obtained than from such as have been fulled ("mungo"), which by tearing become shorter and more worn. Nevertheless, a large quantity of such stuffs are produced — often testifying to great skill in manufacture — such as rugs, blankets, and shawls, coarse stuff for cloaks and coats, and common cloths for wearing apparel.

In certain parts of the country — in the hundred of Nordmark in Värmland Län, for example — there was formerly carried on a very lively domestic industry of homespun (Sw. vadmal). — The cloth was made of pure Swedish wool, and the manufacture was carried on by means of a stamping mill, driven by water-power. In some places this manufacture is still carried on.

Cotton Industry.

This manufacture, although it occupies a very important place in the textile industries of Sweden, is however, confined chiefly to the simpler stuffs, viz., cotton and twills, drill, dress materials, ginghams, fustian, sail-cloth, and cotton drill.

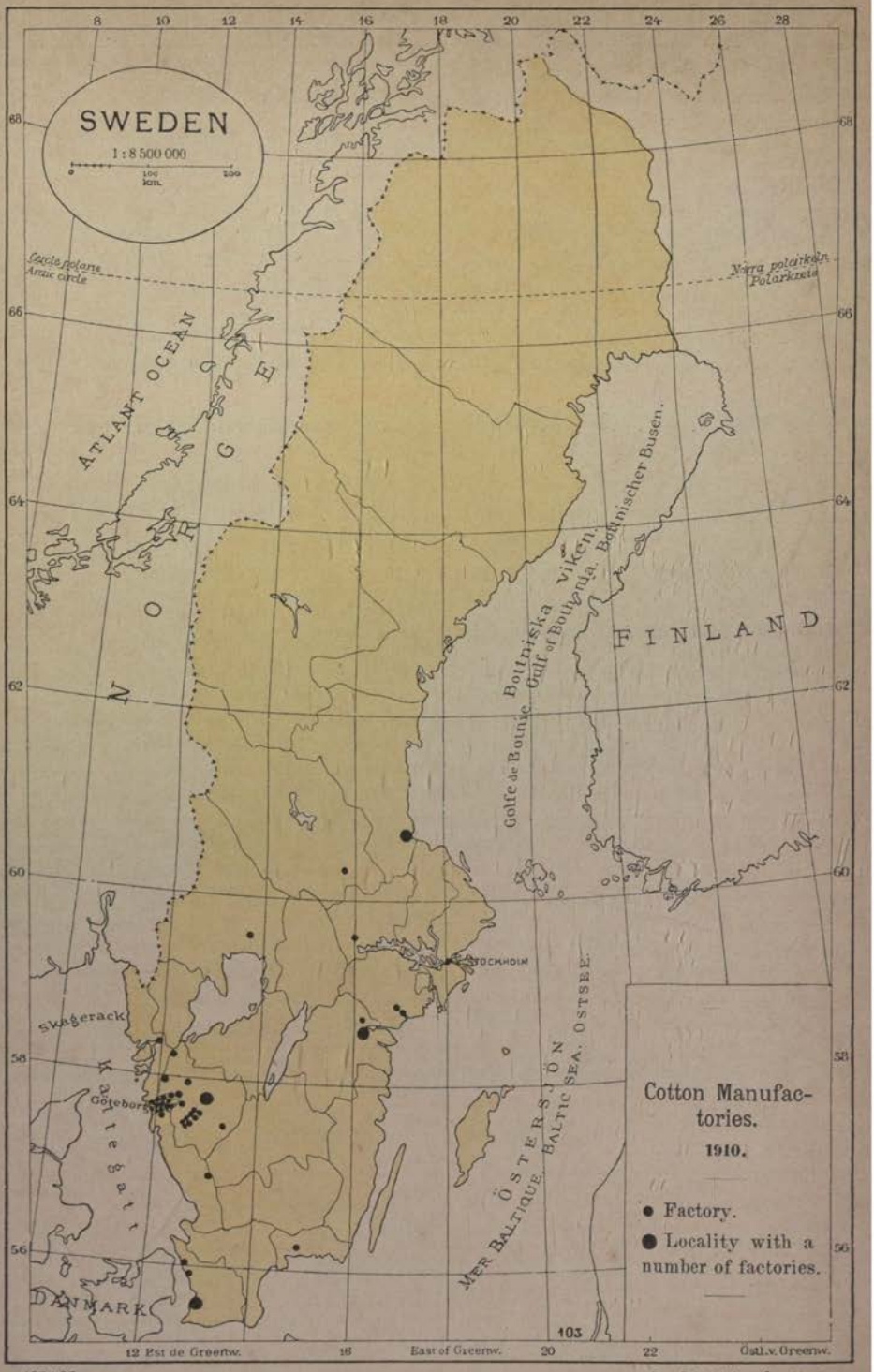


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TABLE 81. *Imports and Exports of Cotton and Cotton-stuffs.* In quintals.

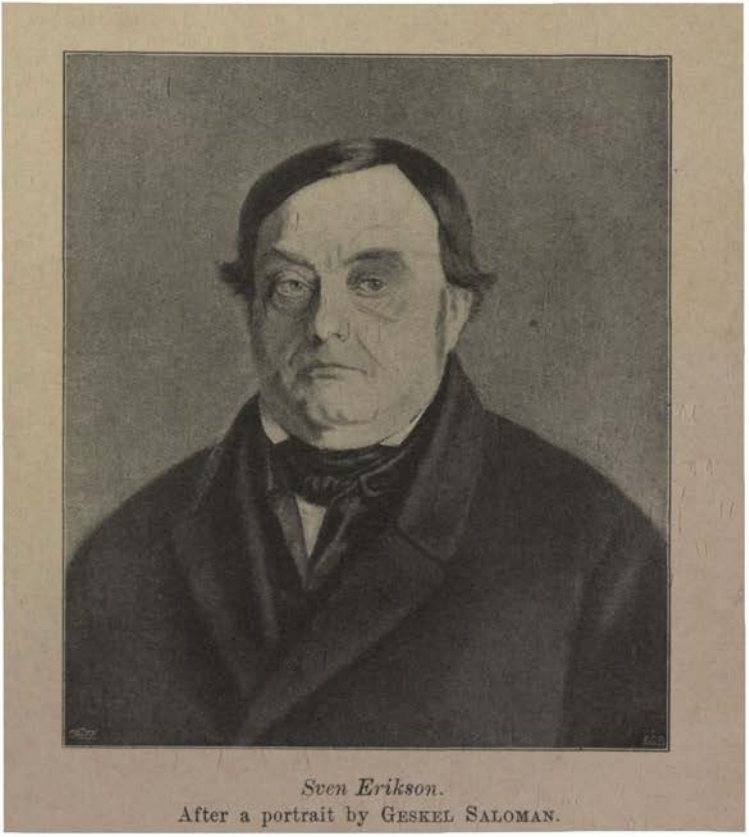
Annually	Cotton		Yarn		Thread		Textile fabrics	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
1861—65 . . .	29 392	—	3 336	490	245	—	3 196	101
1866—70 . . .	54 532	—	5 057	140	354	—	3 750	1 077
1871—75 . . .	79 206	—	16 363	338	722	2	10 171	1 347
1876—80 . . .	83 836	—	17 786	800	1 137	5	8 122	1 771
1881—85 . . .	109 806	—	20 976	2 849	2 023	17	10 384	3 655
1886—90 . . .	117 481	—	17 036	5 127	2 503	23	12 176	4 755
1891—95 . . .	141 476	—	21 329	4 812	2 944	4	15 415	8 059
1896—00 . . .	166 779	—	30 836	3 625	3 159	1	18 561	5 657
1901—05 . . .	178 965	—	11 359	4 048	3 272	1	16 404	1 821
1906—10 . . .	201 233	1 527	12 611	3 069	3 341	1	19 942	1 141
1908	212 110	1 556	13 542	3 347	2 374	1	17 589	999
1909	173 103	2 134	9 470	3 432	3 622	1	18 699	908
1910	206 947	2 129	10 515	2 344	3 150	—	21 056	1 152
1911	200 400	1 794	9 620	3 084	3 095	—	22 129	1 358
1912	216 596	1 947	11 295	6 896	3 168	—	16 765	2 675

The total **production** value of the Swedish *spinning-mills* was estimated at 12·40 million kronor per annum during the last half of the decade 1861—70; during the earlier half of the decade 1871—80 at 14·39 millions; but, during the last half, at only 12·28 millions. The production then remained at this point up to quite recently, when it made an enormous advance, rising from about 20 million kronor in 1900 to 30 millions in 1910. From the *weaving-mills* the following figures are given: for the decade 1861—70, a yearly production of 4·67 million kronor: for 1871—80, 10·12 millions, without any decline during the last part of the decade; for 1881—90, 12·71 millions, and, for the first half of the decade 1891—1900, 12·88 million kronor. There, too, the value of production remained stationary quite a long time, but for 1898 it is stated to be no less than 21·46 million kronor, from which it rose in 1912 to 35 million kronor. It ought, however, to be observed that the figures before and after 1896 (owing to altered statistics) are not fully comparable. — The number of hands engaged in the cotton industry amounted in 1912 to 12 309, of whom 5 525 were engaged at the spinning-mills and 6 784 at the weaving-mills. The corresponding figures for 1898 were 11 413 hands, the value of the goods produced being 39 million kronor, i. e., 3 417 kronor per head, that year, as compared with 5 159 kronor per workman in 1912. This shows an increase in the production per workman of nearly 50 %, showing the sound development and economic management of this branch of industry.

The **imports** are, as regards quantity, given in Table 81. Their value was estimated in 1912 at 23·83 million kronor for cotton; for cotton yarn at 3·20 millions; for thread at 2·77 millions, and for textile fabrics at 9·31 millions or, altogether, 39·11 million kronor. With the exception of the last few years, the import of cotton presents a very steady increase, and it has almost doubled during the last decades. The greater part comes from Great Britain. The *exports* go chiefly to Norway.

The first more important mechanical cotton-spinning mill in Sweden was established at Lerum about 1800, and the first mechanical weaving-mill — the Rydboholm Art Weaving mills — the latter being established at

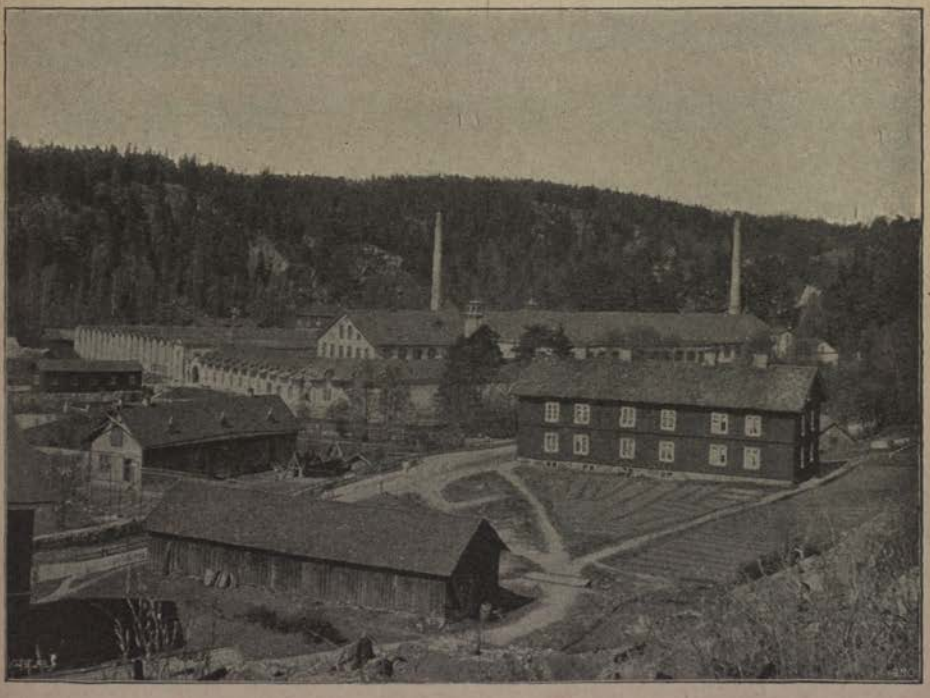
Kinna by *Sven Erikson*, one of the great names in the history of the Swedish textile industry. Erikson began with a so-called "money-advance-business" (Sw. förläggareaffär) for the manufacture of woven articles in his native district, the hundred of Mark in Västergötland; then he gradually extended the scope of his operations by the erection of a spinning-mill, whereby the weaving-mill became independent of foreign yarn, and the factory became the largest of its kind in the country. At the present day the Swedish cotton industry employs 500 000 spindles and 13 000 looms.



Sven Erikson.
After a portrait by GESKEL SALOMAN.

As an important modern factor in this industry may be mentioned the increasing use that is made of the so-called automatic looms, i. e., those looms possessing a device for the automatic introduction of the weft into the spindle. Of these there are now some 3 000 in use, chiefly Northrop looms. The Rydboholm Weaving Mills, Ltd., at Viskafors, for example, have all their looms provided with the device in question. They are employed chiefly for smooth, plain cloths, as experience has shown that they do not always give a perfectly faultless product. The ring-spindle machines, too, have been generally introduced, in place of the so-called "self-acting" or mule spinning machines. The larger

spinning-mills and weaving-mills have introduced artificial moistening of the air in the weaving-sheds, which is maintained at a constant temperature and percentage of moisture, whereby the hygienic conditions have been improved and the output increased. Finally, another important factor is the increasing employment of electric power, not only for the looms but also for the spinning machines. The Gamlestaden factories, in Gothenburg, for example, a few years ago introduced electric motive-power transmitted from the State power-station at Trollhättan, and several other mills have followed the example.

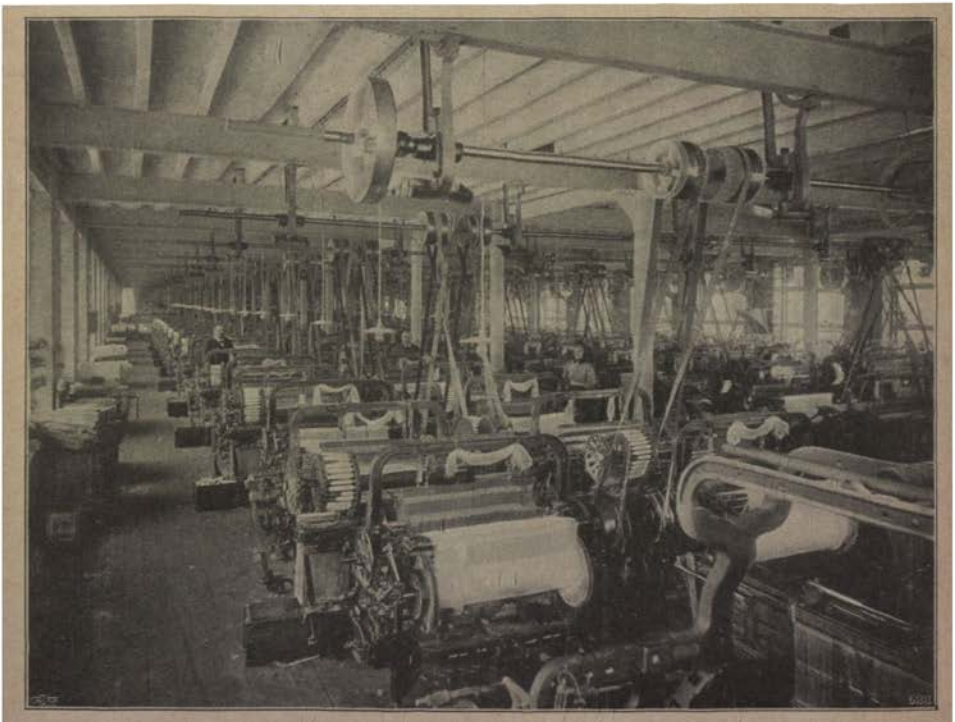


Viskafors Cotton Spinning- and Weaving-Mills.

Among the larger establishments for the manufacture of these stuffs may be mentioned: *Gamlestadens fabriker* in Gothenburg, with 45 800 spindles, 970 looms, *Krokslätts fabriker (Claes Johansson & Co.)* in Gothenburg, *Norrköpings bomullsväveriaktiebolag, Holmens fabrik* (and *Bergs bolag)* in Norrköping, *Borås väveriaktiebolag, Nääs* spinning-mill, the *Viskafors, Fritsla, Kungsfors, Alingsås* factories, etc. In Stockholm there is a large spinning and cloth factory at *Barnängen,* and the Gävle Manufacturing Company has a large factory at *Strömsbro.*

Of late years, very successful efforts have also been made in this branch of industry to manufacture goods that demand greater skill on the part of the workmen. For instance the *Svenska gardinfabriken* (the

Swedish Curtain Manufactory) in Gothenburg, with a branch in Christiania, since the abrogation of the commercial treaty between Sweden and Norway ("mellanrikslagen"), manufactures so-called thread curtains or network textiles, white as well as coloured, which have already secured a firm footing on the market and are, as far as quality is concerned, fully worthy of comparison with the best obtained from abroad. These goods are exported as well. There is a Norwegian competitor in the trade at Bergen, who has had a branch-works at Svartvik, outside Stockholm, since the abrogation of the commercial treaty between Sweden and Norway.



Room with 500 automatic weaving-looms (Claes Johansson & Co., Krokslätt, Gothenburg).

What is noticeable within this department is the great extension of **domestic handicraft** (hemslöjd) in certain districts, which has almost developed into a home industry. Such is the case more especially in the Län of Älvsborg, viz., in the neighbourhood of Borås and Ulricehamn, and in the hundreds of Mark, Kind, and Ås, where the country-people, owing to the indifferent nature of the soil, have turned from agriculture to weaving. Here, the former extensive cultivation of flax and the linen industry have completely made way for cotton-weaving. The rich peasants are the suppliers; i. e., they supply the yarn on credit to their dependents, who carry on weaving in their homes and afterwards sell to the suppliers. Both Jacquard and other tapestries, more particularly linen and twill, undyed and dyed stuffs, are the objects of this home industry, which produces about a quarter of all our manufactures of cotton stuffs. The goods are strong,

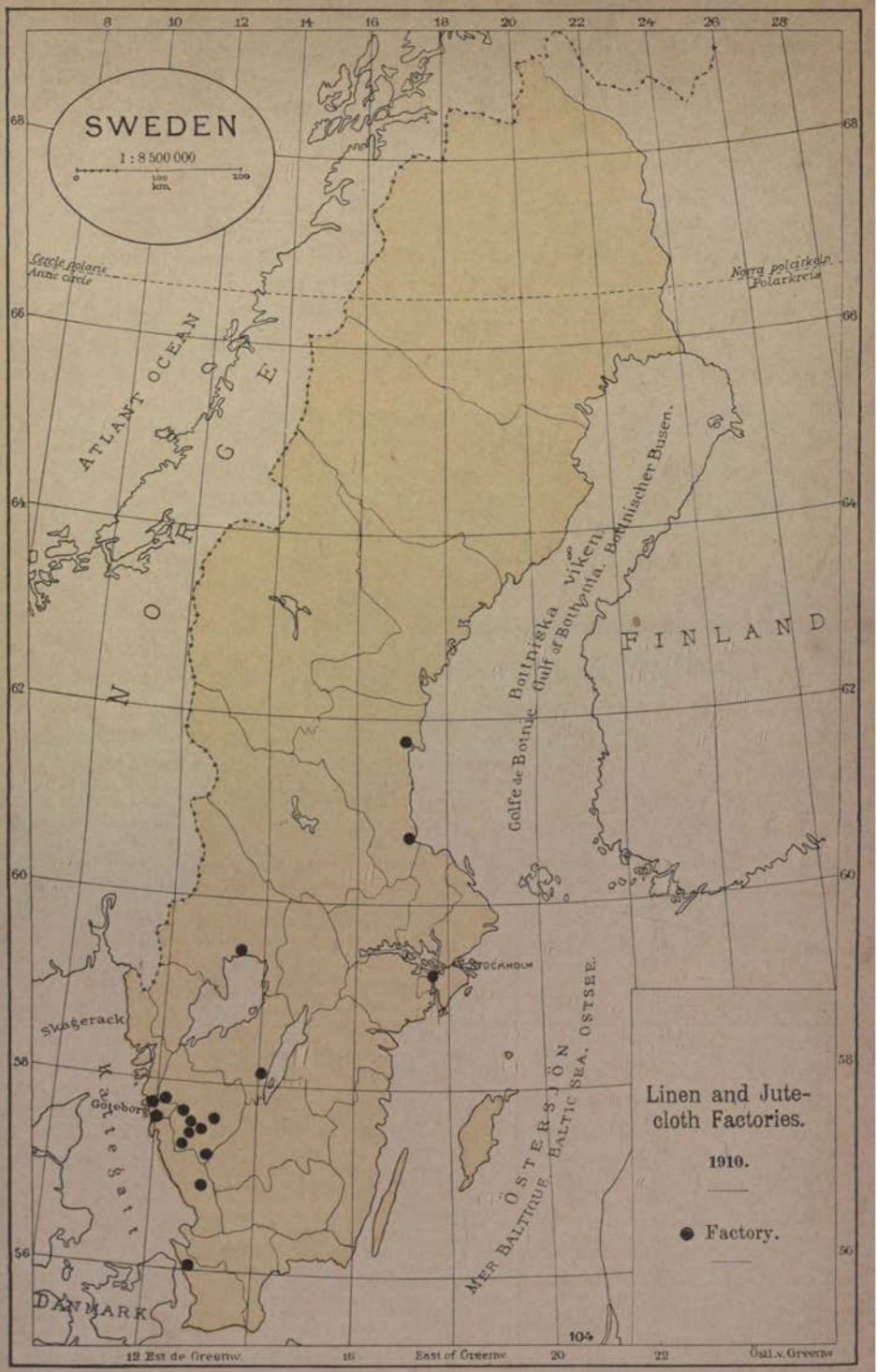
good, and cheap, but they are often wanting in finish. A certain division of labour with respect to different sorts of weaving has been introduced, so that in some parts of the country only dress materials are woven; in others, domestic and other white linens; in others, again, huckaback, carpets, curtain stuffs, etc., from other raw materials than cotton as well. As the suppliers, in order to be in a position to compete with the large factories, are obliged to pay very low prices to the weavers, their economic position is a bad one. Of late years, however, much has been done, especially by the home-sloyd associations of the country, to improve the position of these home-workers, as, for example, by the acquisition of time-saving and labour-saving machines, the choice of suitable patterns, the improvement of the workpeople's dwellings and hygienic conditions, etc., all of which has enabled them to compete more successfully with the great industries and, at the same time, has considerably improved the less attractive features of this system of employment.

Printed cotton goods are manufactured at a few factories, among which *Rydboholm* on the Viskaån River, in Älvsborg Län, is the principal. Cotton prints, cretonnes, etc., of recognized good quality, are produced here, although, as regards variety in patterns, they cannot compete with those from abroad, as the expensive printing-rollers are not manufactured in the country.

Linen and Jute-cloth Industries, etc.

The Norrland provinces, Hälsingland, Ångermanland, and Jämtland, are renowned in Sweden for their excellent flax and fine linen, but Småland, Halland, and Västergötland also occupy an important place in this respect. In the middle of the nineteenth century, much was done both by the Government and the Riksdag, as well as by private individuals, for the promotion of the linen industry. Especially noticeable is the bonus-system introduced in 1740, according to which the makers of linen of a certain fineness (there were 8 classes) were rewarded, and, consequently, manufacturing skill was raised to a high pitch of perfection. As early as 1741, *D. Kropp* obtained certain privileges on his establishment of a linen manufactory at Härnösand, in Ångermanland. — The manufacture of sail-cloth, especially, is a very ancient industry in Sweden. In the middle of the 18th century it was in such a flourishing state that it was able not only to satisfy the home demands but also to export considerable amounts, especially to the countries of the Mediterranean.

The *retting* of the flax takes place in the northern parts of the country in pools of still water; in the southern parts, on the other hand, on meadows — then called dew-retting. The Norrland flax is usually of a light grey, nearly white colour; that from the southern parts, e. g., Småland, is grey and more uneven in colour. The cultivation of flax has steadily declined. In 1875, 36 490 quintals were gathered; in 1898, only 16 529 — a reduction of 55 %. The Swedish linen industry has, however, at the same time somewhat increased, very large quantities of flax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FINLAND
STOCKHOLM
Skagerack
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Linen and Jute-cloth Factories.
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being imported, but the home manufacture is far from sufficient to supply the needs of the country.

Among the 11 existing linen-mills in Sweden, mention may be made of *Almedal, Jonsered,* established 1833, *Dalsjöfors,* and *Holma* (Tidaholm), with a total production-value of nearly $7^1/_2$ million kronor in yarn and stuffs. The reason that the linen trade is of subordinate significance, in spite of the fact that flax of splendid quality can be produced in Sweden, must be sought for, partly in the increasing popularity of cotton stuffs, partly, and more especially, in the difficulty of obtaining sufficient raw material of even quality, and, finally, in the difficulty there is in obtaining labour for the troublesome preparation of the fibres. The country people do not carry on the retting in a rational way; the sorting of the flax purchased by the factory proves difficult to do, and the product thus becomes very uneven. Attempts have been made in Hälsingland at retting the flax on a large scale, by purchasing the raw flax from the peasantry, and manufacturing the flax into yarn and linen-cloth. The chief difficulty is to secure a sufficient supply of raw flax. In 1912 there were 15 200 linen-spindles and 1 000 linen-looms at work in Sweden, and the value of the production has more then doubled during the last ten years.

Jute *(Corchorus capsularis),* a raw material of this class, has of late years become the object of a rapidly developed and most extensive trade, the leading representatives of which are *Skandinaviska Jutespinneri- och väveri-aktiebolaget* (Jute factory) at Oskarström (which turns out goods to a value of about 3 000 000 kronor annually) and *Svenska Juteväveriaktiebolaget,* Södertälje (established 1889, and employing about 360 hands

TABLE 82. *Imports and Exports of Flax and Hemp, and Articles manufactured from them.* In quintals.

Annually	Flax		Hemp		Yarn and thread of flax and hemp		Linen and hemp cloth	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
1861—65 . . .	2 315	34	17 109	27	194	1	1 366	91
1866—70 . . .	3 544	576	16 641	17	432	5	2 433	339
1871—75 . . .	4 398	485	19 443	38	1 159	6	5 395	586
1876—80 . . .	5 469	147	16 023	61	1 209	3	3 295	503
1881—85 . . .	5 140	27	15 992	208	1 596	27	3 518	463
1886—90 . . .	5 845	4	16 797	139	1 489	1	2 984	358
1891—95 . . .	7 256	—	18 681	130	1 661	1	3 933	211
1896—00 . . .	6 622	—	22 472	46	3 000	18	5 891	108
1901—05 . . .	11 583	152	25 208	234	2 739	32	4 995	74
1906—10 . . .	16 483	71	26 832	38	2 056	195	5 447	116
1908	14 327	98	30 381	65	1 548	38	4 395	108
1909	13 303	40	22 511	9	1 983	298	5 177	111
1910	18 447	103	26 361	17	2 080	629	5 987	130
1911	17 268	—	31 032	21	2 261	1 051	7 531	138
1912	25 102	—	30 187	103	2 803	683	4 867	242

and with a production-value of about 1 ½ million kronor), and the *Skånska jutefabriks-aktiebolaget,* Hälsingborg. These manufactories have exceedingly varied productions, comprising jute-yarn, netting yarn, mat warp, string, rope, etc., and sacking, packing, mattress and decoration-cloth, saddle-girths, and mats. Jute is also used in certain factories, together with wool or cotton, for curtain- and furniture-cloths, as well as carpets. The eight jute-factories of Sweden employ 1 560 workpeople, and the average annual value of their production is 9 000 000 kronor.

The value of the **manufactures** at Swedish flax and hemp spinning-mills was, in 1912, 3·50 million kronor, and at the weaving-mills, 4·86 millions; at the jute spinning-mills 4·47 million kronor, and at the weaving-mills 4·80 millions. (The calculation include overlapping, as the production figures in general.)

The **imports** of linen and hemp goods are, as regards quantity, shown by Table 82. The values of the several imports were: flax, 2·28 mill. kronor; hemp, 2·17 millions; hards, 0·50 million; jute, 2·98 million, yarn and thread for 0·78 million, and flax, hemp, and jute textiles 2·22 millions; total 10·93 million kronor. The import of linen has increased, but not sufficiently to compensate for the above-mentioned decline in the home production.

Certain **other fibrous materials** have been used for the manufacture of cloth, although more by way of experiment. Special mention may be made of Prof. *H. v. Post's* experiments, made in the 'sixties, for the manufacture of yarn and cloth from the *down of plants*, i. e. seed catkins of willows and osiers (Salix), and of aspens and poplars (Populus), especially the down of Salix pentandra. Other vegetable down-producing species, such as Eriophorum, Sonchus, Typha etc., have been experimented with in Sweden, but all without practical results.

Another raw material made into home-manufactured cloth by the peasantry in certain places, was the ordinary *nettle* (Urtica dioica), which was treated like flax and produced a particularly good, strong, and long fibre. The cloth thus produced rivalled linen in quality; it was exceedingly fine and strong and was called "nettle-cloth", a name that has now been transferred to certain kinds of thin cottons.

Of late years, attempts have been made in Sweden to employ *peat-fibre* for the manufacture of cloth (i. e. the stalk and root fibres of certain species of Eriophorum), either alone or spun up together with wool. The fibre is generally obtained as a by-product in the process of making peat-coal. Such cloth has been manufactured at the *Sahlström* Manufactory in Jönköping, and the yarn spun with about 40 % of fibre and 60 % of sheep's wool. The cloths which have cotton in their warp and fibre yarn in their woof are fulled. This manufacture has not, however, led to any practical result, probably from want of perfectly satisfactory fibre and the special machinery necessary for cleansing and spinning.

Silk Industry.

The Swedish silk industry, at present of exceedingly unimportant dimensions, should be regarded as a relic from a time when the people and the ruling princes always regarded it as essential to a country's welfare to introduce and encourage every industry at any price, whether there was any probability of its flourishing in that country or no.

As early as in the middle of the seventeenth century, there was a silk manufactory with 50 looms in Stockholm, and in 1673 one *Jurgen Enhorn*, from

Hamburg, obtained leave to set up a silk manufactory in Gothenburg or Landskrona, where plush, velvet, and silk ribbons also might be manufactured. The sale was bad in consequence of the import of such goods, on account of which all introduction into the country of such articles was forbidden in 1683, and a special "silk-house" was established under government control, all silk stuffs having to be furnished with its stamp and seal. The silk was brought from Persia and other places in Asia, and also from South Europe. After the long wars of Charles XII, the silk trade led a languishing existence, but recovered again under the eighteenth century's zealous system of protection and bonuses.

In the middle of the last-named century, many attempts were made to introduce the cultivation of the silkworm into Sweden. In 1750, there were something like 100 000 white mulberry trees to be seen in Lund; native silk was actually produced in spite of the northern latitude, and the State supported the project with bonuses and grants, in the hope that it might call into being a new home industry. In 1830, a "Society for promoting the rearing of native silk worms" was established, under the patronage of the then Crown Princess Josephine, and with illustrious men of science, such as Berzelius, Sven Nilsson, and many others, as members. The production of silk was, however, never very large, possibly 10 or 12 kg per annum; and more particularly after the yearly Government subvention of 4 000 kronor was withdrawn in 1876, it may safely be said that the undertaking lost all significance as far as Swedish industry was concerned. The attempts made by this Society seem, however, to demonstrate that the so-called oak silk-worm (*Bombyx Yama-Mai*), a Japanese species, can thrive exceedingly well in Sweden. The Society ceased its operations in 1898, after nearly 70 years' work without practical results. The last year's yield (about 2 kg) was obtained at the Society's institution at Alnarp in Skåne.

Although, in 1845, there were 18 silk manufactories at work, at present Sweden has only one, viz., *K. A. Almgren's*, Stockholm. This factory (established 1834) certainly produces excellent simple silk stuffs (taffety, gros, croisé, rep, satinet, atlas, and a certain amount of damask) for wearing apparel, kerchiefs, ribbons, and neckties. Notwithstanding the high duty on imported silk goods (6 kronor per kilogram, while the raw silk is admitted duty free), this industry continues to decline. Silk goods are fashionable articles, and, as such, often subject to fluctuation, and they are therefore hardly likely to be manufactured at a profit in so small a country as Sweden. The silks of home manufacture probably cost 50 % more than the French, and the former are inferior to the latter with regard to colour, though possibly somewhat superior in durability.

Especially interesting are the attempts that have been made in Sweden to produce the so-called *artificial silk*, or collodium thread. This method consists in pressing fine threads out of a gelatinized solution of cellulose (cotton, straw, or chemical wood-pulp) through extremely fine holes in glass tubes; this thread is in quality very much like natural silk. The inventions in this branch of trade have not, as yet, given rise to any industry, but may be said still to be in the experimental stage. The fabrics, which have hitherto been manufactured of this material have consisted of natural silk in warp and cellulose silk in woof, the latter, as regards durability, however, being considerably inferior to the former. Such silk has also been manufactured in Sweden of *sulphite*, presumably for the first time in any country. This silk, however, becomes yellowish and is difficult to bleach.

Sweden's **imports** of pure and cotton-silk fabrics has, in yearly averages for the five-year periods 1871—1910 and for the year 1911, been estimated at respectively 2·78, 2·90, 3·44, 4·73, 3·16, 4·66, 4·80, 6·76, and 7·59 million kronor. Of the sum for 1912, 3·75 millions were for pure silk and 2·89 millions for cottonsilk.

Other Manufactures in the Clothing Industry.

Of the large number of manufactures in these branches there are a great number which chiefly fall within the department of handicraft and home-manufacture, while the manufacturing industry, properly so called, has, on the whole, made only its first entry into the domain of Swedish industries. This is due to the smallness of the home-market and the obstacles lying in the way of exports on a large scale. The development of these special trades, however, has made very rapid progress. For example, the number of the sewing factories has risen during the last ten years from 24 to 64, and the value of their products from 4 million kronor to 15 millions. Sweden is still obliged, however, to rely on a considerable **import** from the countries that set the taste in these branches. The entire value of the imports in 1912 amounted to no less than 25·90 million kronor. The largest items were *ribbons* (silk, and others) 2·16 million kronor; *embroideries* 1·94 million kronor; *hats* 1·96 million; *clothes* and clothing-articles, 6·84 millions, including household articles of all kinds, such as table-linen, etc.; further, *lace-work*, 0·69 million kronor; *lace*, 1·05 million; *stockings* and *stocking-loom work*, 2·65 millions; *thread-gloves*, 0·91 million; *waterproof stuffs*, 3·61 million kronor, etc.

The branches which, in 1912, had the largest **manufacture** in the branches in question are the following:

	Factories	Work-people	Value of Manufacture, kronor
Sewing factories	68	4 920	17 622 142
Stockinet factories and hosieries	59	3 681	13 156 708
Dyeing works and Calendering works	116	2 161	5 608 567
Hat factories	24	1 219	4 685 257
Cap factories	21	761	2 710 594
Tent-Cloth, and tarpauling factories	13	264	2 602 397
Curtain factories	2	349	1 800 000
Ribbon factories	17	440	1 497 577
Necktie factories	7	398	1 165 018
Corset factories	6	453	1 396 000
Cotton-wool factories	13	199	994 381
Brace-factories	4	278	868 631
Umbrella- and parasol factories	8	101	814 965

Of dye and bleach works for yarn and cloths there are a large number but mostly small ones; still there are some which work on a larger scale; the most important are the dye-works of *Levanten*, near Gothenburg. At the large wool and cotton factories there are also dye and bleach-works established, quite sufficient for the greatest demands that can be made nowadays in this branch.

Of late years arrangements have been made at several textile works for the *calendering* of a large proportion of the woven material brought from abroad, the goods being *re-exported* afterwards, the Customs then restoring the amount of duty paid on the raw goods, allowance being made for the loss of weight the material has suffered during the process. This process of preparation, which is chiefly applied to cottons and woollens, usually comprises dyeing, printing, and mercerizing. Among the more important factories in this branch may be mentioned the *J. F. Vennerstens fabriksaktiebolag*, Borås.

Of **stockinet-factories** the largest are to be found in Älvsborg Län, and in the towns of Malmö, Gothenburg and Karlstad.

The most important **sewing-factories** are *Wettergren & Co's* mantle-factory in Gothenburg, and *Aktiebolaget Moresco*, Malmö.

Hats manufactured in Sweden are principally of felt. The most important factories for goods, of this kind are in Stockholm, Falköping, Karlskrona and Malmö.

Machines and Apparatus used in the Textile Industry.

Of the large number of *machines* used in the textile industry, only a small number are manufactured in Sweden, although, for instance, the manufacture of ordinary machine-looms for simple cotton cloths could, for several reasons, be carried on at a profit here. The *Huskvarna factory* makes *sewing* and *knitting machines* of acknowledged good quality. *P. Persson's counting apparatus,* with the pattern discs belonging to it, has proved of great importance, in domestic industry especially, as it facilitates the work in the manufacture of a large number of articles of clothing by the ordinary knitting machine. For *dyeing,* bleaching, and washing cotton, as well as in the department of calico-printing, *G. Jagenburg,* of Rydboholm, has made several important inventions, and there are several clever Swedish inventions for impregnating cloth for the purpose of rendering it waterproof or less inflammable. *E. Schenson's* swingle apparatus for treating flax, and *R. Strehlenert's* arrangement for spinning artificial silk may also be mentioned. Electricity also has been utilized, as in *G. Wenström's* device in singeing-machines for cotton cloth, and *G. Cassel's* device in cutting-machines. Weavers' reeds are made at the *Mora* factory.

Kristoffer Polhem (1661—1751) made many important inventions in textile machinery, especially in the stockinet industry, which sprang into existence during his time. There still exist, for example, several of Polhem's pedal stocking-looms at the Polhem Museum at Falun, manufactured at the Stjärnsund works established by him in Dalarne at the beginning of the 18th century. He also invented a ribbon-loom for the simultaneous weaving of several ribbons; a wool-washing machine; a cloth-press, etc.; and he invented a number of other very ingenious machines, such as mechanical spinning-looms and carding-looms, which, however, could not be constructed from want of skilled labour.

The import of machinery in this branch, chiefly from Great Britain and Germany, amounted in 1912 to about 1·9 million kronor. The value of the machine-imports for the years 1910 and 1911 is shown in the following table. It must be noted, however, that the figures here given are not quite comparable with the total value for 1912 on account of alterations in the official grouping of wares, distributed as follows:

	1910 Kronor	1911 Kronor
Looms	581 000	550 000
Spinning machines	672 000	658 000
Mangles (Callenders, etc.)	36 000	31 000
Bobbins	142 000	146 000
Carders and card-leather	119 000	116 000
Opening machines, Willows, carding-machines, etc.	919 000	859 000
	2 469 000	**2 360 000**

For exercising control over the textile industry in Sweden, both for individual and State needs, the *Material-testing Institute of the Technical High School* has a special department furnished with the requisite apparatus for the purpose. In addition to microscopic examinations of the fibre substances of yarn and cloth,

tests of different kinds are made as to the strength of the material. For example, yarn is tested as to strength, elasticity, evenness, purity, and uniformity, the quality of the thread and the fibre; cloth is tested as to strength, elasticity, durability, perviousness to gases and fluids, permanence of dyes, shrinkage. Even separate fibres are examined with regard to strength and spinning qualities. For these various purposes there are modern apparatuses, dynometers for stresses ranging from 1 gram to 500 kg, etc., some of which have been constructed specially for the Institute.

3. HIDES, SKINS, AND HAIR.

The official statistics make the following distinctions between the several different manufactures under this general heading; the figures are those for 1912 (handicrafts excluded):

	Factories	Workmen	Value of production, kr.
Tanneries	198	1 850	30 355 000
Fur goods factories	22	498	4 511 000
Shammy leather factories	2	10	59 000
Total	**222**	**2 358**	**34 925 000**
Shoe factories	86	6 765	36 043 000
Glove »	16	351	865 000
Other »	48	784	4 517 000
Total	**150**	**7 900**	**41 425 000**
Grand total	**372**	**10 258**	**76 350 000**

The advance which has been made in this industry will be seen from a comparison with the returns for 1898, which were, respectively, 685 factories, 7 461 workmen, and a production of the value of 24 271 000 kronor. The number of factories has thus decreased by 46 %, that of workmen increased by 37 %, and the value of the production shows an increase by 214 %.

The more important increases in the production of the wares referred to in the groups will be seen from the following tables.

Tanneries.

The splendid development of tanning since the middle of the decade 1891—1900 is to some extent fictitious owing to subsequent statistics being fuller, but it is, nevertheless, to a great extent real, partly owing to improved technics in general, as is proved by the increased amount of production in proportion to the number of workmen, partly from the general employment of tanning extract, and also from the more favourable duties which came into operation in the beginning of the decade 1891—1900.

Shammy-leather tanning has always been inconsiderable, showing an average yearly production of only 3 475 kronor between 1861 and 1865;

TABLE 83. *Tanneries.*

Annually Altered statistics from 1896	Number	Workmen	Value of production in thousands of kr.
1861—65	658	1 897	4 554
1866—70	656	1 566	4 404
1871—75	679	1 896	7 241
1876—80	666	1 787	5 676
1881—85	658	1 685	5 185
1886—90	618	1 666	5 139
1891—95	578	1 810	5 908
1896—00	561	2 401	9 681
1901—05	456	2 332	15 355
1906—10	276	2 034	23 291
1910	243	2 084	28 878
1911	226	1 915	27 959
1912	198	1 850	30 355

this sum rose to 142 000 kronor between 1896 and 1900, but then there was a decrease to 59 100 kronor for the year 1912.

Tables 83 and 84 show that at the same time as the manufacture in Swedish tanneries has rapidly increased, the import of *bottoms leather* (sole-leather and insole leather) has rapidly decreased. The export is

TABLE 84. *Imports and Exports of Hides and Skins.*

Annually	Leather Quintals		Other dressed[1] hides and skins Quintals		Undressed hides Quintals		Fur-goods Value in thousands of kronor	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
1861—65	1 386	11	315	29	25 342	2 540	.	.
1866—70	1 879	202	357	9	23 229	6 119	.	.
1871—75	6 426	295	1 044	18	36 595	6 737	669	141
1876—80	15 007	938	1 472	70	20 227	8 860	504	119
1881—85	20 256	818	2 044	40	24 648	13 779	700	82
1886—90	20 178	355	2 678	48	28 848	17 982	1 159	128
1891—95	24 613	1 047	4 427	105	30 756	20 171	1 652	534
1896—00	25 720	61	6 955	142	46 385	35 264	2 575	445
1901—05	10 623	116	8 088	215	74 780	57 904	1 997	360
1906—10	3 531	315	7 654	359	99 032	78 536	2 928	870
1910	4 814	41	8 484	628	124 777	100 785	3 580	980
1911	2 965	288	8 957	709	111 017	134 868	3 576	1 174
1912	2 680	575	7 240	502	119 740	113 732	5 810	4 010
Value in thousands of kronor								
1906—10	748	68	8 084	271	11 872	7 066	2 928	870
1910	1 100	10	10 193	565	15 243	8 652	3 580	980
1911	700	70	10 483	562	13 842	13 564	3 576	1 174
1912	784	117	10 728	446	15 569	15 206	5 810	4 010

[1] Not including furs.

inconsiderable. Other dressed hides and skins are continually imported in large and increasing quantities, the value for the year 1912 being about 10·7 million kronor, of which the larger part consists of "dyed" skins (upper-leathers of all kinds) for 9·8 million kronor, the next most important being *patent leather* to the amount of 600 000 kronor. The manufacture of this sort of skins is, however, on the increase in Sweden, so there are prospects that the imports will gradually decrease. The imports and exports of hides have balanced, so that the values are also nearly equal.

Undressed hides and skins (not furs) are chiefly sent over Norway, Denmark, and Germany as transit goods from the Argentine and East Indies, sole-leather principally from the United States, dyed skins from Germany, Denmark (in transit), and the United States. The export of undressed hides is chiefly to Norway and Germany, of which a part is in transit to North America.

The largest tanneries in the kingdom are in the district of Stockholm (Järla), in Valdemarsvik, Sölvesborg, Nättraby, Simrishamn, Malmö, Landskrona, Ängelholm, Falkenberg, Vänersborg, Alingsås (chevreau), Gävle, and Malung in Dalarne (finer sorts of skins). At the beginning of the decade 1901—10, *chrome tanning* was introduced into Sweden, a process which had long before been in vogue in other countries. There are factories for chrome tanning in Klippan (Skåne) and Askersund.

Other manufactures.

Shoes. Shoemaking as a trade has now little importance since the large shoe factories with up-to-date American machinery began to compete with improved and cheaper shoes. Since the commencement of the manufacture of shoes in factories in the decade 1881—90 the turnout has risen rapidly to a value of 36 million kronor in the year 1912 (see Table 85) and is thus one of the largest industries in Sweden. The principal shoe factories are in Örebro and in the Läns of Stockholm, Malmöhus, Göteborg och Bohus, and Älvsborg. The import of shoes is inconsiderable; about 450 000 kronor in 1911; the export is practically nil.

TABLE 85. *Shoe Manufactories.*

Annually Altered statistics from 1896	Number	Workmen	Value of production in thousands of kr.
1881—85	2	47	65
1886—90	5	243	469
1891—95	12	874	2 157
1896—00	34	2 592	8 134
1901—05	49	3 824	14 755
1906—10	80	5 845	24 408
1910	89	6 776	34 138
1911	86	6 680	33 692
1912	86	6 765	36 043

TABLE 86. *Fur and Glove Factories.*

Annually Altered statistics from 1896	Fur factories			Glove factories		
	Number	Workmen	Value of production in thousands of kr.	Number	Workmen	Value of production in thousands of kr.
1861—65	—	—	—	9	256	96
1866—70	—	—	—	8	198	158
1871—75	—	—	—	9	268	327
1876—80	—	—	—	11	380	486
1881—85	—	—	—	6	388	490
1886—90	1	38	143	8	370	512
1891—95	5	220	735	9	325	532
1896—00	15	558	2 153	19	592	1 059
1901—05	19	515	2 658	21	467	976
1906—10	25	565	3 776	21	399	962
1910	25	522	4 017	19	384	934
1911	21	466	3 623	17	367	814
1912	22	498	4 511	16	351	865

Gloves. The manufacture of gloves is an industry of old standing in Skåne, whence the name *Skåne gloves*. Lamb-skins and goat-skins are used almost exclusively for glove-making. The so-called gants de Suède are a special sort of shammy-leather gloves with the flesh-side of the skin outermost. Elk, reindeer, and buck-skins are also employed for gloves. The chief seats of the glove-making industry in Sweden are Malmö, Lund, and Hälsingborg. Particulars are shown in Table 86; the value for the last 13 years approaches 1 million kronor yearly; in 1912, 490 000 pairs were made. The imports in 1913 were of the value of 266 000 kronor and the export negligible.

According to Table 86 the **fur factories** show a considerable productive value, 4 million kr. during the last few years. To this must be added an import of furs for about 5·8 million kronor and an export of 4·0 millions for 1912 (see Table 84 above). The imports come chiefly from Finland, Germany (transit goods), and Denmark, the exports go chiefly to Norway, Germany and Finland.

The value of the manufactures in the **saddle trade** was 692 000 kronor in 1912, that of **brush-making** 1·5 millions, **leather strap factories** 918 000 kr. and other manufactures comprised in the above group, 1 410 000 kronor.

4. OILS, TAR, INDIA-RUBBER AND ALLIED COMMODITIES.

In this section a distinction is made between the industries which produce the raw material and those which refine and manufacture it. The totals in 1912 show, in each case, the following figures:

	Factories	Workmen	Value of production
Production of raw material	125	762	17 135 000 kronor
Refining industry	107	2 930	24 636 000 »
Total	**232**	**3 692**	**41 771 000** kronor

It is also necessary for Sweden to import considerable quantities of these articles as well, while the export is much less. The chief import is petroleum (lamp-oil), in 1912 to a value of 14·6 million kronor. (Mineral-oils to a total value of 22·2 million kronor.) Then come fatty oils and tallow to a value of 23·7 millions, about half going to the margarine factories. The import of paraffine amounts to 837 000 kronor: india-rubber to 14·2 millions, and oil-cakes to 23·4 millions, of which further details are given below. The chief exports are tar (524 000 kronor), galoshes and other india-rubber goods (6·17 millions). The total exports within this group amounted to 10·5 million kronor in 1912.

Fatty Oils.

The only fatty oils Sweden produces on a large scale are: **linseed-oil** and **rape-oil**. They are derived from the corresponding seeds by means of pressure. The leavings, after the process of pressing is completed, are used in the form of **oil-cakes**, or ground as food-stuffs for cattle. **Fish-oil** was produced from herring about the year 1890, when large shoals visited the west coast, in connection with the production of herring-guano, though now the production is only exceptional. The herring was boiled in water, when the fat rose to the surface and was skimmed. What was left was pressed, and a new quantity of oil obtained and more or less *refined*, before being placed on the market. The refuse left in the press was then dried for herring-gauno (See under section: Artificial Fertilizers). **Train-oils** are also produced, chiefly as a home industry in connection with seal-shooting.

The total number of factories belonging to this group amounted in 1912 to 20, with 196 workmen and a production-value of 9 641 000 kronor, of which amount 5 198 000 kronor were for 70 295 quintals of linseed- and rape-oil, and 3 399 000 kronor for 276 948 quintals of oil-cake. — Fatty oils are used to a large extent in making hard and soft soap, stearine candles, oil-colours, and varnishes. The manufacture of oils and oil-cakes does not nearly cover the demand of the country. *The import* is consequently considerable, as may be seen from Table 87.

TABLE 87. *Import of Linseed and Rape-seed, Fatty Oils and Tallows, Oil-cakes, and Train-oil.*

Annually	Linseed and rape-seed kronor	Fatty oils and tallows kronor	Oil-cakes kronor	Train-oil kronor
1871—80	1 340 000	2 526 000	1 168 000	.
1881—90	1 695 000	3 746 000	2 580 000	385 000 [1]
1891—95	2 312 000	4 737 000	3 279 000	516 000
1896—00	2 718 000	7 019 000	4 268 000	539 000
1901—05	5 501 000	7 674 000	9 736 000	555 000
1906—10	5 557 000	13 447 000	16 812 000	503 000
1910	5 956 000	22 860 000	17 868 000	688 000
1911	7 182 000	20 388 000	20 369 000	580 000
1912	7 227 000	23 715 000	23 382 000	518 000
1913	9 028 000	22 706 000	20 904 000	569 000

[1] The figure 385 000 kronor expresses the average for the years 1886—90.

In greater detail, the import of linseed during 1913 amounted in value to 8 663 000 kronor, rape- and colza-seed to 365 000 kronor; linseed-, rape- and colza-oil to 226 000 kronor; and sweet or olive-, hemp-, palm-, cotton-, soya- and maize-oil etc. to 5 842 000 kronor; arachide- and sesame oil (chiefly for the manufacture of margarine) to 2 475 000 kronor; cocoa-nut oil (also chiefly for manufacture of margarine) to 9 881 000 kronor; all in barrels. In other vessels, to 34 000 kronor. The large increase in the import of oils beginning with 1910 — the import-value rose all at once to 7 million kronor — was due to the increase in the use of cocoa-nut oil in the margarine industry (See: The Margarine Industry). *The export* of fatty oils and tallows in 1913 only amounted to a value of 944 000 kronor.

Mineral Oil.

Mineral oil is generally imported in a refined form as **petroleum** (lamp oil), **benzine,** and **lubricating oils,** but some is also refined in Sweden itself. There are no sources of mineral oils in Sweden. It was the two brothers *L. and R. Nobel,* themselves Swedes, who established the *Russian petroleum industry,* on the peninsula of Apscheron, in the Caspian Sea. Under their management, this Russian industry has developed to such an extent that it can compete with the American in certain branches.

The *import* in 1913 was:

	Tons	Kronor
Crude petroleum	15 346	1 535 000
Petroleum refuse	1 513	182 000
Lamp oils	120 476	16 867 000
Lubricating oils	22 373	3 765 000
Benzine	15 414	4 932 000
Other oils	4 809	577 000
Total	**179 931**	**27 858 000**

In 1912 most of the crude oil and petroleum refuse came from Austria and Russia, of the petroleum (lamp oil) 72 % from America, 1 % from Russia (chiefly for compressed air-lamps, such as the "Lux"), via Danmark, 18 %, and via Germany 5 % etc. The lubricating oils came chiefly from America, Russia, and Germany, in the last-mentioned case probably chiefly as transit shipments. Benzine came from the Netherlands, from Germany — most likely from raw material received from the Sunda Islands and refined in Hamburg —, and from America.

The following table, drawn up from official Swedish statistics, will serve to show the import of petroleum (lamp oil) into Sweden:

Annually	Import in quintals	Per annum and inhabitant kg	Price pr kg in öre
1871—75	66 707	1·5	36
1876—80	113 860	2·5	26
1881—85	182 294	4·0	20
1886—90	310 484	6·5	19
1891—95	449 116	9·3	15
1896—00	622 710	13·6	15
1901—05	749 908	14·4	15
1906—10	988 837	18·5	15
1910	1 013 786	18·3	13
1911	1 181 176	21·3	11·5
1912	1 040 442	18·6	14
1913	1 204 759	21·4	14

The export of mineral oils in 1913 amounted to a value of 1 163 000 kronor.

The production of mineral oils and **machine** and **carriage lubricants** in Sweden in 1912 amounted to a value of 1 036 000 kronor. In this connection, it may be mentioned that without mineral lubricating oils, which stand great heat without decomposing, the steam-engines of the present day would hardly have attained their high stand-point.

Glue and Gelatine.

Various parts of animal bodies contain substances which, if boiled for a considerable time in water, dissolve and yield glue. A technical distinction is made between **leather-glue**, obtained from various refuse matter from hides and sinews, and **bone-glue,** obtained from the bones of animals, from which the fat is extracted by benzine; the bones are then thoroughly boiled in water under pressure, the glue being thereby dissolved, or also in hydrochloric acid, which dissolves the mineral ingredients and leaves the glue. The bone-fat, which possesses the soft consistency of lard, is used in the manufacture of hard and soft soaps, stearine etc. Finally, **gelatine** is an almost colourless, tastelass, and odourless glue, prepared with great care, and appearing in a finished state in very thin leaves. The raw material for the manufacture of gelatine consists of the hide of calves' feet and heads; the hide is first subjected to processes for removing the fatty ingredients and the hair. The principal variety of fish-glue is **isinglass,** which is the dried inner membrane of the air-bladder of a number of sturgeon varieties. In connection with the manufacture of glue may be mentioned that of **roller-composition,** obtained by dissolving glue in glycerine of a given strength, to which is added sugar. The ordinary roller-composition used by printers is blackened with lamp-black.

In 1912 there were 7 factories for the manufacture of glue and gelatine, employing 229 workmen, and producing goods to the value of 1 228 000 kronor. There were also 3 factories for roller-composition, their production amounting to a value of 19 700 kronor. The production of glue has been given in the factory statistics with increasing figures. *The import* is insignificant; in 1913 it amounted to a value of 164 000 kronor, including isinglass and gelatine. The export amounted in value to 18 500 kronor.

Tar and allied Substances.

In earlier times, when the value of timber was not so great as it is now, **tar-burning** and **pitch-boiling** were very customary, especially in the forests of Norrland; at that time, wood-tar was one of the chief exports from Sweden. Nowadays, tar-distilling is almost entirely confined to the two most northerly läns, where it is carried on as a domestic industry. Figures for the export in recent times have already been given in Table 39, Page 218.

About the year 1870, a number of **wood-oil factories** sprang up, the purpose of these being to turn to advantage the stumps of coniferous trees, left behind when the timber was felled and removed. By means of dry distillation, certain products were obtained from these stumps and other pinewood, such as tar, oil of wood-tar, wood-oil, etc. Of these, wood-oil is the most valuable, possessing, as it does, certain of the chemical properties of turpentine oil. In the year 1912, there were 26 factories, employing 117 workmen in producing these substances, the value of which was then 1 153 358 kronor, distributed as below.

The manufacture of **coal-tar** is dealt with in a later chapter under chemico-technical industries.

	Kg	Kronor
Pitch and pitch-oil	219 651	20 875
Tar and tar-oil	6 041 614	564 254
Wood-oil	84 622	8 433
Wood-spirit at 100 %	613 646	358 507
Turpentine and turpentine-oil	675 991	201 289
Total	**7 635 524**	**1 153 358**

Carbolic Acid, Creosote, etc.

From the distillation of coal-tar a number of different products are obtained: among others, all the substances which form the basis for the manufacture of **aniline colours,** viz.: benzole and its homologues, aniline, phenol (carbolic acid), naphthaline, anthracene, chinoline, etc. The preparation of colours, artificial medicines, etc. from these substances gives rise to an extensive and profitable industry in several countries. In Sweden, the distillation of coal-tar is carried on for the preparation of only a few products, such as carbolic acid and oils used for the preservation of wood (called carbolineum), naphthaline, asphalt-varnish, and asphalt-tar. That this industry has not made more progress in Sweden than is the case at present may perhaps be due to the preponderating attention devoted to inorganic chemistry at the expense of organic.

India-Rubber

is manufactured chiefly in three different forms: pure india-rubber, vulcanized india-rubber, and ebonite. **Pure** india-rubber is soft and elastic, and is used in the production of sheets, pipes, gloves etc., specially for surgical purposes. **Vulcanized** india-rubber is used, partly by itself, partly with an insertion of a strong woven material, for tubes, tires, straps, etc. **Ebonite** is a kind of india-rubber vulcanized by a special process; it is used for many purposes, by reason of its great power of effecting electrical isolation and its property of resisting the action of acids. **Galoshes** consist primarily of a woven material covered with a thin coating of slightly vulcanized guttapercha or india-rubber. The use of india-rubber goods increases year by year; india-rubber galoshes have become a well-nigh indispensable article of wear for a large proportion of the inhabitants of the country, even for the poorer classes. The popularity of bicycling and motoring has occasioned a very great consumption of india-rubber tires.

Galoshes and other rubber articles are now manufactured at several factories, which have been erected since 1890, and these have been able to compete successfully with those abroad. Of the eight rubber factories in Sweden, employing 1 686 hands and producing goods to a value of 10 998 000 kronor in 1912, those in *Hälsingborg, Malmö, Gislaved,* and *Trälleborg* are the largest. Of the total output in this industry in 1912, not less than 87 % (by value) came from these factories. About the year 1870, the total output in the rubber trade in Sweden amounted to only a few thousand kronor. *The import* of the raw material, as well as of manufactures, has also increased considerably, and was valued at 13·5 million kronor in 1913, 6 982 000 kronor of which were for raw rubber and guttapercha; 1 496 000 kronor for tubes, pipes, and straps; 553 000 kronor for shoes; 3 494 000 kronor for rubber-tires; and 1 020 000 kronor for other articles in the rubber-trade. In recent years, there has also arisen a notable *export,* which was valued at 3·16 million kronor in 1913, 2 241 000 kronor being for shoes; the greater part goes to Norway and Denmark, Germany, Belgium, France, Austria, and the East Indies.

Candles.

Up to about the year 1860, **wax** candles and "steeples" and **tallow candles** were almost the only kind of artificial light, for, though colza-oil lamps attained a certain degree of popularity, the tallow candles dipped at home were and remained indispensable in every household, until the time when gas and American petroleum almost simultaneously became known and brought into use. In place of tallow candles, **stearine candles** are now almost universally employed, and in recent years, **composition candles** (of stearine and paraffine wax) or, more seldom in Sweden, **candles** of **paraffine wax**, in cases where, for some reason, candle light is preferred or must be used. The manufacture of stearine candles in Sweden dates from 1841, when *L. J. Hierta*, a prominent and active man in many directions, in conjunction with *J. Michaëlson*, established the factory at *Liljeholmen*. In 1843, *Lars Montén* founded the Clara candle-factory, the second of the kind in the country. In 1912, Sweden had five stearine candle factories, with 369 workmen and an output of 22 823 quintals of candles, valued at 1 975 000 kronor, mostly of pure stearine. Besides this, in both the stearine factories of Liljeholmen and Clara, the by-products *glycerine* and *oleine* were obtained to a value of 502 000 and 596 000 kronor respectively. The import of candles in 1913 amounted to 20 600 kronor, of glycerine to 445 000 kronor, of oleine to 457 000 kronor, and of stearine to 127 000 kronor. The exports were 37 500, 185 000, and 144 000 kronor respectively.

In the manufacture of stearine candles, certain fatty substances are used for raw material, such as tallow and various oils consisting of a mixture of fluid and solid fat, chiefly oleine, palmitine, and stearine. In the manufacture of candles, these so-called *neutral fats* are decomposed by the actions of some base, such as lime, magnesia, or oxide of zinc, under pressure or with concentrated sulphuric acid, and during recent years in an emulsion with diluted acid, into glycerine and oleine, palmitic and stearic acids. *Oleic acid* is fluid at ordinary temperatures, *palmitic* and *stearic acids*, on the other hand, are solid, and, after due purifying, these are employed in the moulding of candles. The by-products in candle-making, glycerine and oleic acid (oleine), are collected and purified separately. *Glycerine* is utilized in a large variety of ways, as a medical agent, but chiefly for cosmetics and for nitro-glycerine. *Oleine* (oleic acid, as it is incorrectly named in the trade) is employed both in the manufacture of hard and soft soap, and as a dressing agent for wool in the textile industry.

The consumption of candles in Sweden may be seen from the following figures:

Annually	Kg
1881—85	1 481 000
1886—90	1 578 000
1891—95	1 761 000
1896—00	2 067 000
1901—05	2 454 000
1906—10	2 407 000
1910	2 503 000
1911	2 211 000
1912	2 239 000
1913	2 415 000

Scents.

Scents, in the ordinary sense, are most frequently solutions of fragrant substances in pure spirit. In general, scents and the choicer soaps are made in the

same factories. The whole output of scent was valued at 1 107 000 kronor in 1912, and the export at 100 000 kronor. The number of factories was 23 employing 81 hands, in 1912.

Hard and Soft Soaps

are obtained by the decomposition of different kinds of fat, both solid and fluid, by means of alkalies. Generally speaking, hard soap is soda, soft soap, potash, chemically combined with fatty acids to form salts. The **boiling** of **hard soap,** like so many processes, used to be done on a small scale to supply domestic needs; from wood-ashes and lime was obtained the required potash lye, which was boiled with an admixture of tallow. A soft tallow soap was the result, from which, by the addition of common salt, a firm and good hard tallow-soap was obtained. The first **soft-soap factory** in Sweden was founded in 1823 by *Lars Montén*, in co-operation with the famous chemist, Berzelius. Though the raw materials for this industry, especially tallow, linseed oil, and train-oil, might partly be obtained in the country itself, the greater proportion of the raw materials used are now brought from abroad, because the home production is insufficient, more especially since certain oils obtained from tropical plants, such as cocoa-nut oil, palm-oil, etc., have begun to be used in soap-making. Soft soap used to be generally employed for washing, but has latterly been superseded by hard soap. For cheap toilet soaps, *cocoa-nut oil* is primarily made use of. Soaps have also been recently manufactured by taking, first of all as neutral a soap as possible, and grinding, perfuming, and pressing it. Besides other good qualities possessed by soaps prepared by this method they also admit of being **scented** better and more lastingly than others.

The production of soft and hard soaps has made great progress in Sweden during the last 50 years. In 1860, there were 13 factories producing 2 105 000 kg of a value of 859 000 kronor.

In 1912 there were 60 factories, employing 745 workmen and producing 24 472 000 kg, valued at 10 236 000 kronor.

The consumption of cleansing materials, which is considered as a standard of civilization, has increased about seven times per person and per annum in Sweden, in spite of the fact that alkalies are now much used directly for cleaning purposes. The price of soft soap and hard soap has, on an average remained the same as then, 40·8 and 41·8 öre pr kg. respectively but for hard soap alone it

TABLE 88. *The Manufacture of Soaps.*

Annually	Soft soap kg	Hard soap kg	Total kg	Per inhab., annually kg
1861—1865	2 141 879	390 034	**2 531 913**	0·63
1866—1870	3 059 072	285 737	**3 344 809**	0·80
1871—1875	4 567 896	441 228	**5 009 124**	1·14
1876—1880	6 062 230	406 038	**6 468 268**	1·42
1881—1885	6 889 811	422 312	**7 312 123**	1·56
1886—1890	7 150 225	770 331	**7 920 556**	1·65
1891—1895	9 205 783	1 544 436	**10 750 219**	2·18
1896—1900	11 912 229	3 233 664	**15 145 893**	2·95
1901—1905	14 085 820	3 627 667	**17 713 487**	3·34
1906—1910	18 072 212	4 244 243	**22 316 455**	4·07
1910	20 307 546	4 575 283	**24 882 829**	4·51
1911	17 025 571	4 562 856	**21 588 427**	3·90
1912	19 905 353	4 566 820	**24 472 173**	4·38

is the double 39·3 and 79·1 öre pr kg respectively, owing to the fact that better qualities of hard soap are now being used, and, during recent years, to the increased price of cocoa-nut and palm-kernel oil. The price of soft soap, on the other hand, has decreased, 41·2 and 33·2 öre pr kg resp., while the quality has been considerably improved. Since the sp. Commercial Treaty between Sweden and Norway was repealed in 1897, the export has decreased somewhat, while the home consumption has been almost doubled since then. It may also be remarked that, although the quantity of soft soap used still surpasses that of hard soap, the manufacture of the latter has shown a greater increase during recent years. The soaps imported had a value of 302 000 kronor and the export amounted in value to 70 600 kronor in 1913.

Stockholm takes the leading place in this industry, with 10 factories (out of 60) and about 30 % of the total output in 1912; then comes the Län of Göteborg och Bohus, with 8 factories and 19 % of the production.

Other Manufactures.

Of such, **varnish** chiefly deserves to be mentioned here. There were, in 1912, 18 factories for the manufacture of varnish in Sweden. The number of hands employed was 179 and the value of the output was put at 1 733 000 kronor. The import amounted in value to 706 000 kronor in 1913. The export only amounted to 50 000 kronor.

5. TIMBER-WARE INDUSTRY.

Of this important industry, the most extensive of any in Sweden, the branch comprising the production of non-manufactured wooden goods has been treated of in an earlier section, under the heading: Forest Industries. The number of centres for this last-named branch of the timber-ware industry, in 1912, was 1 266, employing 37 958 hands and producing goods to the value of 174 million kronor. It now remains to give an account of the production of *manufactured articles of wood*, this, too, being one of the most considerable of Swedish industries. In 1911 there were 932 factories, employing 33 831 hands, the value of the output being estimated at nearly 179 million kronor. It should be noted that match-making is included in these figures, as is customary in Swedish statistics, though the manufacture in question might, of course, equally well be referred to the chemical industries.

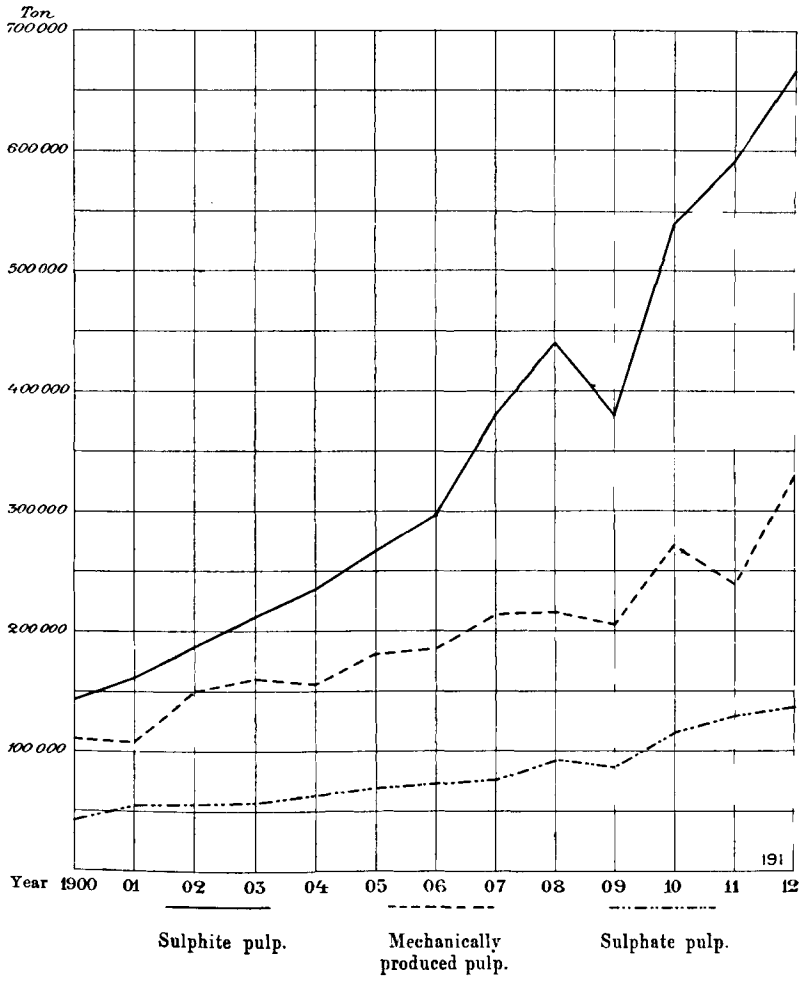
In Table 34, page 193, will be found the figures for the **exports and imports** of manufactured wooden goods (more or less wrought). As will be seen, the export trade is increasing in a very gratifying manner, this being primarily due to the rapid development of the wood-pulp industry.

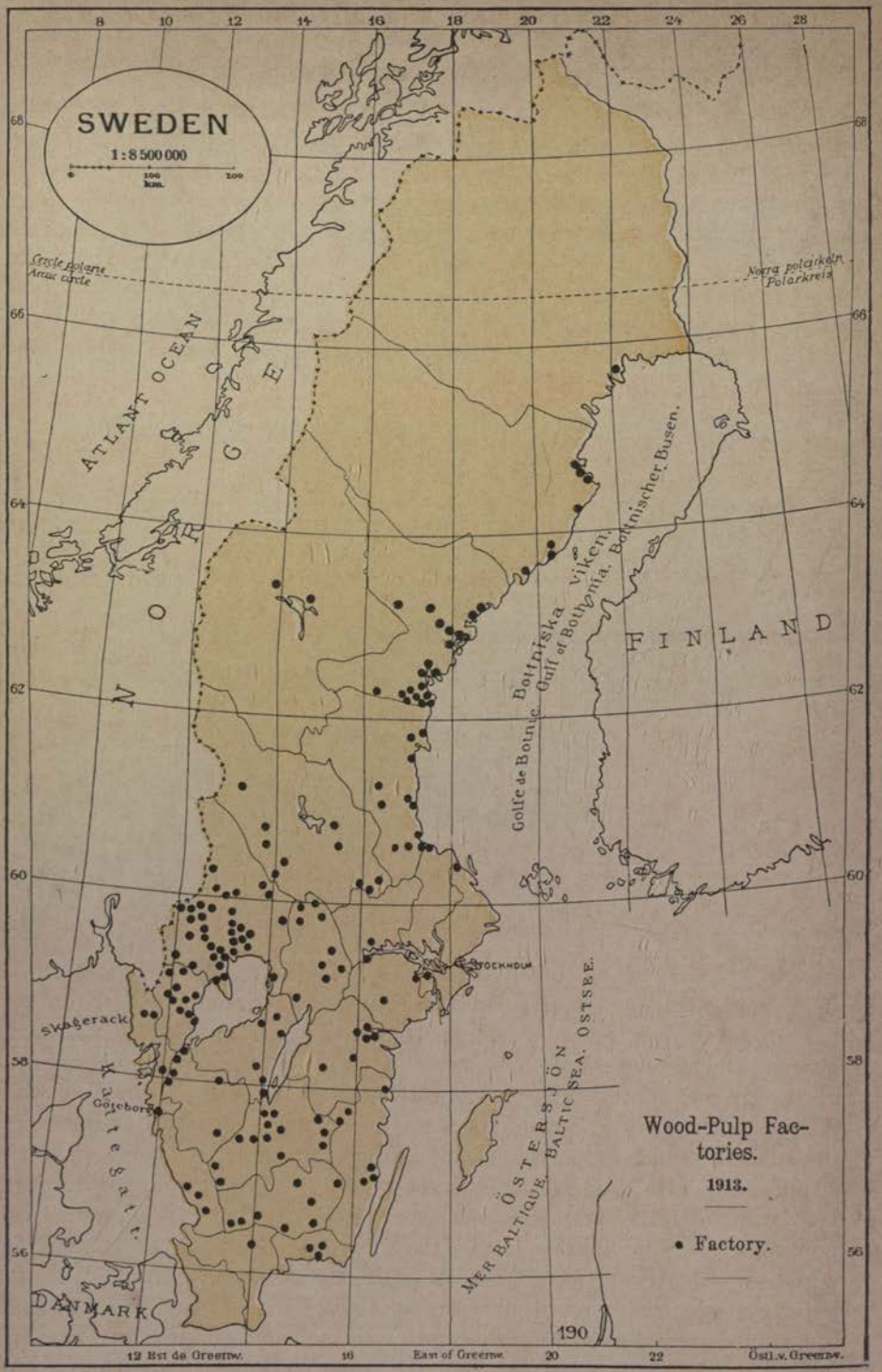
Wood-Pulp Industry.

Wood-pulp may be fairly called one of the natural products of Sweden, owing to the vast supply of timber suitable for its production and the great supply of power in the numerous waterfalls. The manufacture of wood-pulp has, indeed, increased immensely during the last few years, and now forms one of the most important of Swedish industries. As regards exports, the wood-pulp industry is now in the foremost rank, side by side with those of timber and iron. At the present time the export of wood-pulp amounts in value to about 12 % of the total export-trade of the country.

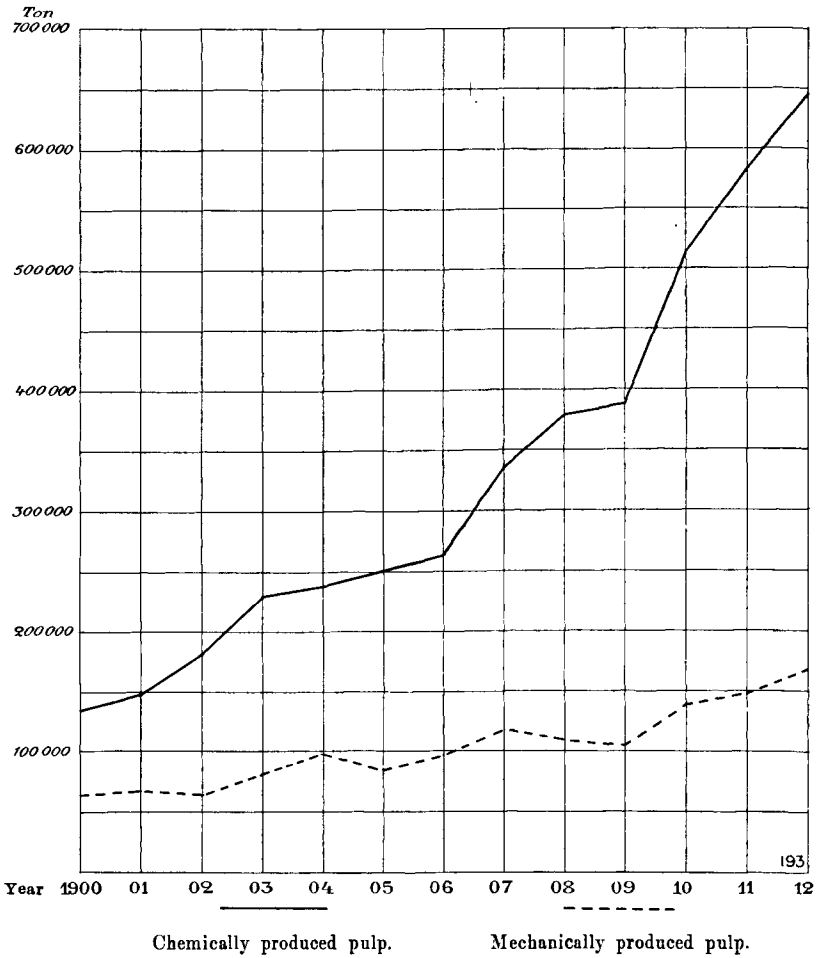
The wood-pulp industry which in earlier days was concentrated chiefly

Production of Sulphite-, Sulphate-, and Mechanically produced Pulp.




SWEDEN
1:8 500 000
100 km.
200
Cercle polaire Arctic circle
Norra polarkretsen Polarkreis
ATLANT OCEAN
NORGE
Bottniska viken Gulf of Bothnia
Golfe de Bothnie
Bottnischer Busen.
FINLAND
STOCKHOLM
Skagerack
Göteborg
Kattegatt
ÖSTERSJÖN
MER BALTIQUE BALTIC SEA OSTSEE
DANMARK
190
12 Bst de Greenw.
16
East of Greenw.
20
22
Östl. v. Greenw.
Wood-Pulp Factories.
1913.
• Factory.

Export of Chemically produced and Mechanically produced Pulp.



in Värmland, though it existed here and there in the south of Sweden too, has, of late years, gained a footing in Norrland, where, at present, nearly half of the wood-pulp of the country is made. The economic importance of the growth of this industry lies, of course, principally in the fact that it represents a higher stage of manufacture than its older sister-industry, the saw-mills industry, with which, to a certain degree, it competes for the supplies of raw material, and which, possibly, it will soon outdistance. But even in this respect, its development represents a fact of immense importance, as it has made possible the economic utilization of timber for which, previously, there had been no profitable use; it has provided a market for timber waste and timber cut for the thinning of forests, this last-mentioned step thus making the wood-pulp industry a means of carrying out a judicious system of forestry. In the technical development of this

industry, Sweden now occupies a prominent place, especially as regards the invention and employment of various new and improved methods.

The first wood-grinding mill in Sweden for the manufacture of wood-pulp by **mechanical processes** (mechanical woodpulp) was established as early as 1857 at Trollhättan, according to Völter's improved adaptation of Keller's system, which was first made practical use of in 1846. From the beginning of the seventies, the number of wood-grinding mills in Sweden rapidly increased until about the year 1895, when the demand for chemical wood-pulp resulted in the rapid establishment of cellulose factories.

The pulp is obtained by the purely mechanical defibration of the wood by grinding blocks of wood against sandstone-grindstones, the whole being kept continually supplied with water. A variation of this raw-grinding is the method of first steam-boiling the wood, which is then either ground or totally defibrated by some other means. This gives the pulp a stronger and tougher consistency, but also a darker colour (brown wood-pulp, Sw. brunslip).

The number of wood-pulp mills in the country is now about 100, the value of the output being some 18 million kronor.

Photo. J. Vestergren, Tumba.

Lessebo Sulphite Mills.

Chemical wood-pulp is manufactured chiefly according to two methods, viz., the soda- or sulphate method, and the sulphite method. According to the soda method, which is the oldest, and was first employed in America during the sixties, the wood, which is first cut into short chips, is boiled under pressure in soda-lye. The first Swedish cellulose factories were established in 1870—71 at Delary and Vermbohl, by Count Sten Lewenhaupt, who later on also opened works at Borkhult and Krontorp, the latter of which is now known as Bäckhammar. The soda-cellulose factories at Gustavsberg (established 1877) and Munksjö (opened 1879) added to the list of this type of factory in Sweden, but although the soda-cellulose manufacturers soon commenced to employ improved technical methods, the system began to suffer from the placing on the market of the cheaper sulphite cellulose. The discovery made by *Dahl*, a German engineer, that soda could be replaced by the cheaper sodium sulphate diminished, however, the cost of production of soda-cellulose, besides which, the method in question gave a larger output of pulp, and a firmer and more easily

bleached mass. This method of manufacture — the sulphate method — is, at present, the alkaline boiling method most employed in Sweden. Another factor of great importance for the cellulose industry was the quality of soda-cellulose produced by A. Müntzing at Munksjö, in 1885, which forms the material for the celebrated Swedish strong brown paper ("kraftpapper"). The number of sulphate cellulose factories at the present time is 21, the value of the output being about 16 million kronor.

The sulphite-method had been suggested as early as 1866, by Tilghman, an American, but it did not become of any practical importance until 1874, when a Swede, *C. D. Ekman*, succeeded in producing on a large scale a satisfactory cellulose, by means of boiling spruce with magnesium bi-sulphite. Independently of the researches of Ekman, who had kept his invention a secret, *Mitscherlich*, a German, some time afterwards obtained good practical results with calcium bisulphite, which has since retained its position as the solvent most employed. The Swede who, next to Ekman, has done most for the technical improvement of the sulphite cellulose manufacture in the country is *C. W. Flodqvist*.

The second sulphite factory to be established in Sweden was Billerud, founded in 1883. Five years later, sulphite cellulose began to be made at Storvik too. At present, the number of sulphite factories is about 65, with an output-value of about 85 million kronor.

The greater part of the wood-pulp produced by mechanical processes is made from spruce, though aspen is also employed, this last-mentioned wood giving a specially white and resin-free product. For brown-grinding, some fir can also be employed. In the sulphate method, both spruce and fir can be used as raw material, although, in some respects, the first-named wood is considered to possess the greater advantages. Sulphite cellulose is made almost exclusively of spruce.

Sulphite cellulose is, of itself, fairly white, and can be employed for making the cheaper kinds of writing- and printing paper without any bleaching. Sulphate cellulose, on the other hand, is more or less dark brown in colour, and is employed chiefly in the manufacture of different sorts of paper in natural colours. It possesses, however, certain qualities that make it specially valuable as a material for the production of finer kinds of paper, a bleaching process being necessary, however. Three of the sulphate cellulose factories in Sweden have large bleaching establishments for the sulphate pulp, one of them being electric.

The chief part of the wood-pulp exported goes to Great Britain and France. Some is sent to the U. S. A., Japan, Belgium, Holland, Germany, Denmark, and Spain. Nearly all the läns of Sweden are engaged in the wood-pulp industry, the chief, however, being Värmland, Västernorrland, and Gävleborg Läns, the total value of whose production is somewhat more than one-half of that for the whole country.

The import of wood-pulp is very small indeed, amounting in 1912 only to about 5 tons.

While the cellulose trade in Sweden has grown in a comparatively short time to a great industry, and one on which a great part of the economy of the country is based, the necessity has not been ignored of obtaining the greatest possible returns from the supply of raw material possessed by Sweden — a supply which, it is true, is rich but, still, limited — by an increased production of cellulose of a high quality, and by the utilization of the various by-products obtained.

Among the many Swedes who have contributed materially towards the investigation of the chemical processes occurring in the manufacture and utiliz-

ation of the by-products, special mention must be made of *Peter Klason*. In addition to turpentine and, in a lesser degree, resin-soap, which are obtained at a number of the sulphate factories in the country, there are produced at three of the sulphite works spirits, obtained from the sulphite-lye by a method developed by the Swedish engineers, *Ekström* and *Wallin*. The amount obtained from sulphite-lye during the period September 1, 1912—September 1, 1913, was 4 313 992 liters 50 % spirits (cf. Spirit Production).

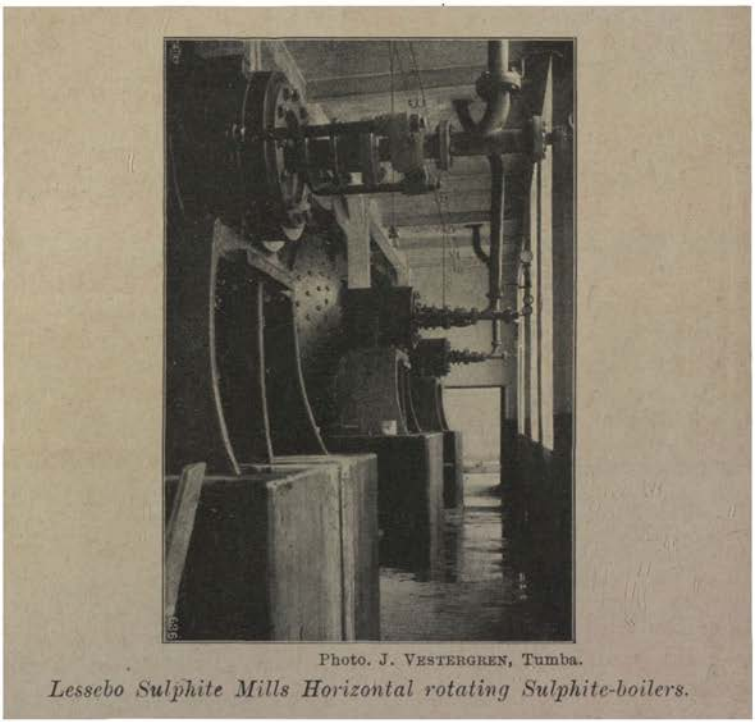


Photo. J. VESTERGREN, Tumba.

Lessebo Sulphite Mills Horizontal rotating Sulphite-boilers.

The development of the Swedish wood-pulp industry since 1871 is shown by the following Table, the quantities being given in dry measure:

Annually	Mills	Hands	Production, quintals	Export quintals	Export value, kr.
1871—75 . . .	19	900	63 499	46 570	1 095 568
1876—80 . . .	24	927	116 631	73 094	1 719 560
1881—85 . . .	32	1 343	234 670	109 795	1 971 552
1886—90 . . .	57	2 765	620 809	418 536	5 050 678
1891—95 . . .	87	4 152	1 554 525	1 061 531	10 216 534
1896—00 . . .	123[1]	6 058[1]	2 596 673[1]	1 977 796	18 830 194
1901—05 . . .	132	7 986	4 304 011	2 906 090	33 770 000
1906—10 . . .	153	11 568	7 190 679	4 900 000	58 948 400
1911	161	12 776	9 582 195	7 357 730	84 307 334
1912	167	13 10	11 258 52[illegible]	8 121 236	93 954 732

[1] Altered statistics from 189

Although there has been a considerable development as regards the manufacture both of mechanically produced pulp and of sulphate-pulp, this

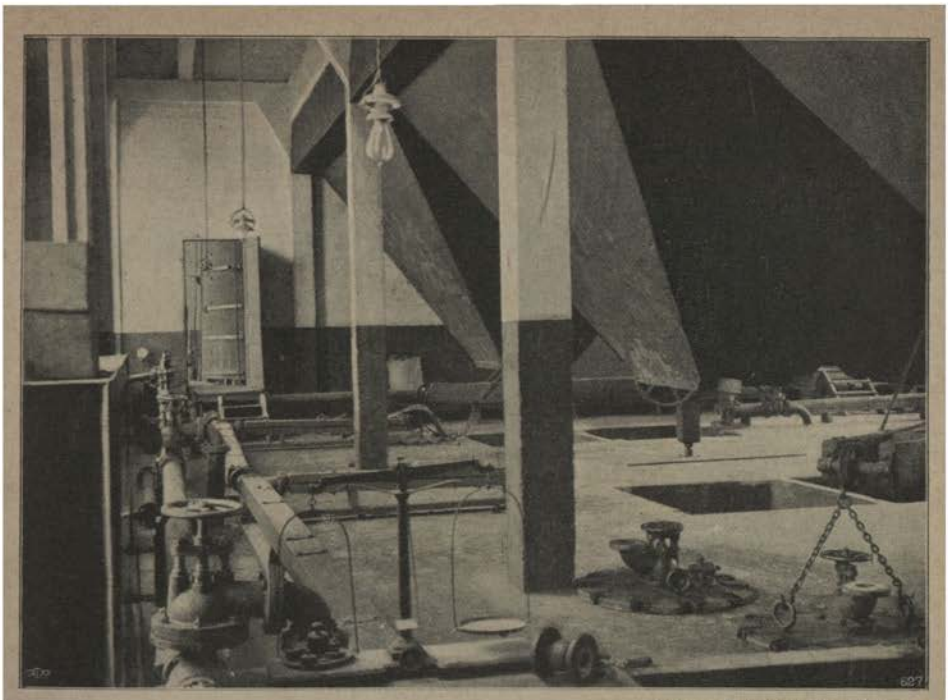


Photo. J. VESTERGREN, Tumba.

Chip-funnels at the Sulphite-boilery, Lessebo.

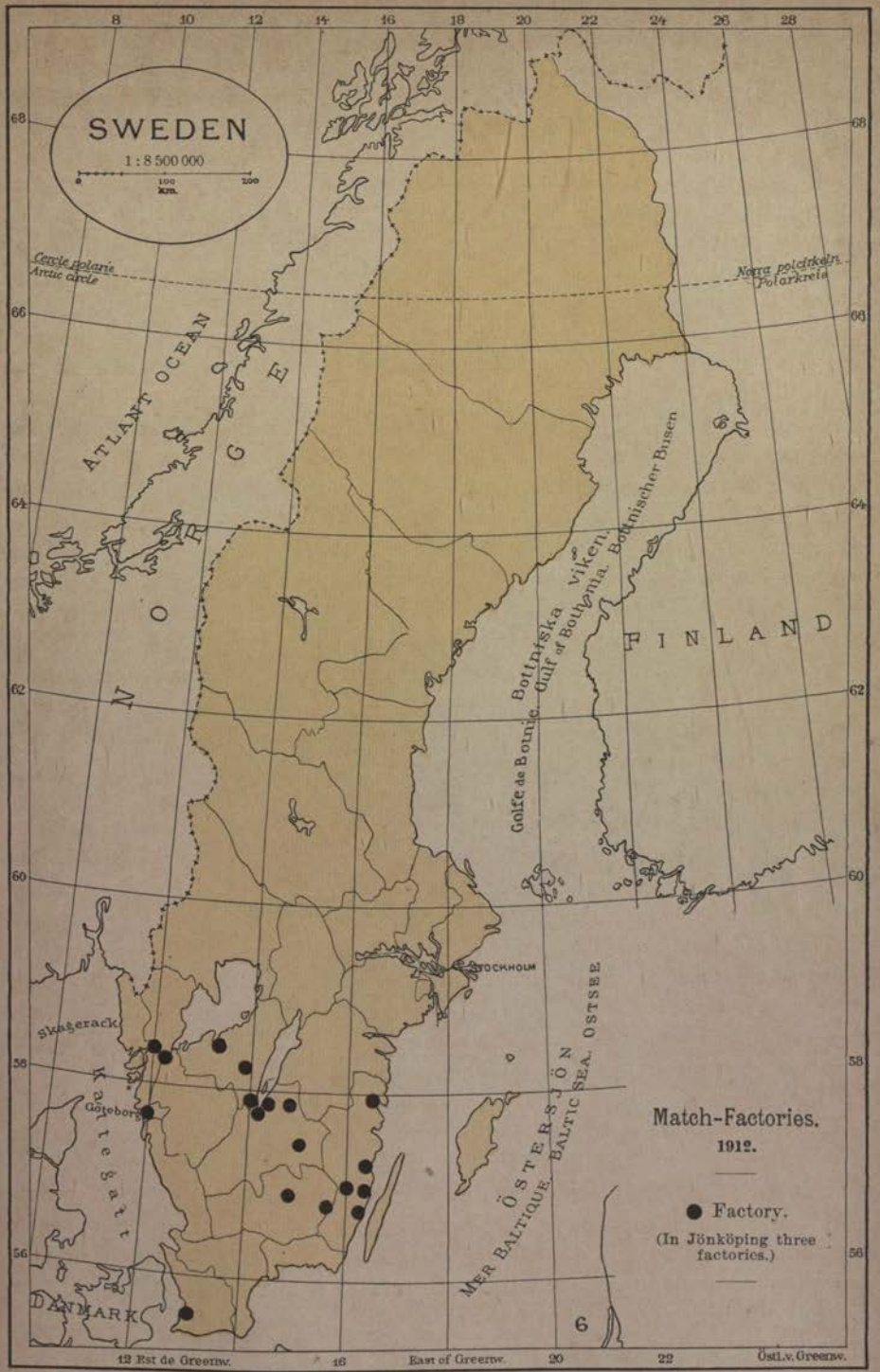
development cannot be compared with that which has taken place in the sulphite cellulose industry. The following Table and graphic figures show how the total production of wood-pulp is distributed among the sulphite-, sulphat- and mechanically produced pulp, both as regards the production and the amount exported. As regards the production, the report has been supplied by Svenska cellulosaföreningen (the Swedish Cellulose Association):

Year	Production, in tons			Exports, in tons	
	Sulphite pulp	Sulphate pulp	Mechanically produced pulp	Chemically produced pulp (sulphite and sulphate)	Mechanically produced pulp
1900	147 000	46 000	125 000	138 096	66 820
1901	160 000	55 000	118 000	148 586	69 876
1902	186 400	55 600	153 000	183 603	67 141
1903	212 500	59 500	165 000	233 819	82 304
1904	233 500	66 500	159 000	242 482	99 138
1905	268 500	71 500	185 000	251 105	84 988
1906	297 500	74 500	188 000	265 626	95 648
1907	383 000	78 000	216 000	339 352	116 489
1908	442 000	95 000	214 000	381 344	109 075
1909	382 500	89 500	208 000	387 458	103 242
1910	543 000	124 000	274 000	510 308	141 457
1911	593 000	134 000	240 000	585 510	150 263
1912	667 000	138 000	330 000	645 792	166 331

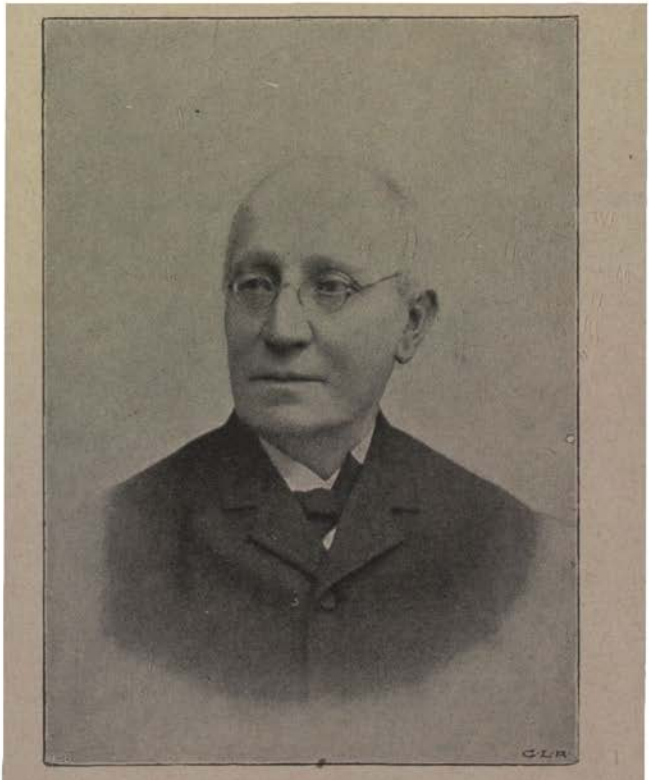
Match Industry.

The manufacture of matches is one of the most important among the Swedish chemical industries. During the thirties and forties of last century, *J. S. Bagge,* professor at the Technical High School in Stockholm, was very successful in his exertions for the introduction of improved means of obtaining artificial light by means of friction matches. Though the importance of ordinary phosphorus in the production of matches of that kind was evident and had actually been pointed out by Berzelius, its use was purposely avoided, until it was discovered that really practical matches could not be obtained without phosphorus in the fulminating composition, and Bagge himself drew up a formula for the manufacture. Phosphorus matches have been produced on a large scale in Sweden since 1843. The world-renowned match-factory in **Jönköping** was started by *Johan Edvard Lundström* in 1844. At first, sulphurized phosphorus matches were almost the only kind made there. In the same year (1844), however, *G. E. Pasch,* professor at the Royal Caroline Medico-Surgical Institute in Stockholm, made the discovery that a rubbing surface containing amorphous phosphorus, called by Pasch phosphorus oxide, could be used for matches with a fulminating composition containing no phosphorus. His invention was patented on October 30, 1844, — a date of importance as proving the priority of Pasch's invention against claims on behalf of a foreign inventor. The manufacture of matches according to the new patent began at once. The method Pasch employed for producing the "phosphorus oxide" was not, however, a very practical one, and it was not until a cheaper method had been discovered in England, in 1851, that his invention could be put to practical use. In this respect too, the priority belongs to Sweden, for in 1852 the Jönköping Match-factory commenced to manufacture those safety-matches which, at the Paris International Exhibition of 1855, were pronounced the best of their kind. The goods turned out by the firm have since attained a world-wide celebrity, and there can be few commodities that have been so often imitated in all parts of the world, both as regards labels and general appearance, as the "Jönköpings säkerhetständstickor" (Swedish safety-matches).

In the progress of the match-industry, it has proved necessary to make great use of labour-saving machines, and many had been brought into use before the beginning of the seventies, more especially such as were calculated to simplify the arranging in frames of the ready-shaped splints previous to their dipping in the igniting composition to form the heads. *A. Lagerman,* by his so-called *"completemachine"*, contributed greatly towards reducing the manual labour in match manufacture to a minimum. One of those machines turns out about 66 000 packed boxes in a working-day of 10 hours. The first machine of this description was put into operation in 1892.


SWEDEN
1 : 8 500 000
100
200
KM.
Cercle polaire
Arctic circle
Norra polcirkeln
Polarkreis
ATLANT OCEAN
NORGE
Bottniska viken
Gulf of Bothnia
Bottnischer Busen
FINLAND
Golfe de Bothnie
STOCKHOLM
Skagerack
Göteborg
ÖSTERSJÖN
MER BALTIQUE
BALTIC SEA
OSTSEE
DANMARK
Match-Factories.
1912.
Factory.
(In Jönköping three factories.)
6
12 Est de Greenw.
16
East of Greenw.
20
22
Östl.v. Greenw.

A large number of other match-factories have gradually sprung up, but many of them have soon been obliged to close, in consequence of the severe competition. Though the old phosphorus matches began to be driven out of the market by the safety-matches, they still continued to be made, but since July 1, 1901, their sale in Sweden has been prohibited, on account of the danger to health connected with the yellow phosphorus contained in the fulminating composition, and also because they had been employed for purposes of abortion. They possess, however, one undeniable advantage over the safety-matches, and that is the possibility of striking them on almost any surface. Continued experiments have, however, resulted in the production at Jönköping of so-called "sesquisulphide matches" which, to a certain degree, can serve as a substitute for the old phosphorus matches without containing the yellow, poisonous phosphorus.



Johan Edvard Lundström.

Most of the chemicals required in match-making, such as phosphorus, antimony, sulphur, paraffine, etc., must be imported; chlorate of potash, on the other hand, can now be obtained in Sweden. The sort of wood in greatest, and almost exclusive, request for matches is aspen; it is

TABLE 89. *Manufacture, Imports, and Exports of Matches.*

Annually	Factories	Hands	Production Value in kr.[1]	Imports Kg	Exports Kg	Exports Value in kr.
1866—70	19	1 858	1 294 000	3 027	1 739 111	.
1871—75	30	3 578	4 377 000	1 319	6 188 671	3 640 000
1876—80	32	3 755	6 301 000	12 725	8 303 090	5 860 000
1881—85	33	4 920	8 176 000	5 092	11 894 943	8 329 000
1886—90	30	5 059	7 875 000	3 316	13 066 366	8 656 000
1891—95	29	5 494	7 923 000	2 996	14 104 983	8 602 000
1896—00	22	5 697	8 342 000	1 801	15 990 035	7 196 000
1901—05	19	5 948	9 968 000	4 875	17 835 161	8 097 000
1906—10	20	6 558	13 904 000	1 670	24 397 362	11 141 000
1910	20	6 758	16 709 000	790	28 547 800	11 854 000
1911	20	6 551	14 985 000	652	28 212 815	11 787 000
1912	18	6 592	16 573 000	467	33 030 194	15 693 000
1913	.	.	.	609	34 614 924	16 413 000

[1] The figures for the exports, in the last column, show that the value of the output in certain years has been put at too low a figure.

easy to cut up and is sufficiently porous to admit of impregnation with sulphur or paraffine.

A most serious obstacle to the progress of the match industry in Sweden, or even to its continuance in its present proportions, consists, not so much in foreign competition, as in the excessively high protective duties imposed by other countries, to the benefit of their own manufacture — duties often so high as to preclude all import — and also the State monopoly on the manufacture of matches established by several countries, e. g., France, Spain, Greece, etc.

The largest match-factories in Sweden at present are: The *Vulcan Factory* at Tidaholm, the *Old Factory* and the *West Factory* at *Jönköping*, besides which, some other factories are owned by the "*Jönköpings och Vulcans tändsticksfabriks A. B.*"

The **exports** of matches go — chiefly via Hamburg and London — to all parts of the world, Of the exports in 1912, amounting to a total of 33 030 000 kg, 12 099 000 kg went to England, 2 752 000 kg to the German Empire, 887 000 kg to the Netherlands, 709 000 kg to Belgium, 10 136 000 kg to the East Indies, 1 336 000 kg to Africa, 3 789 000 kg to North- and South-America, 406 000 kg to Denmark, etc. The total value of the exports was estimated at 15 693 000 kronor.

Joinery- and Furniture Factories.

In many parts of the country, joinery as a *handiwork* employment is very general, and on every farm there is usually one man able to undertake at least rough carpenter's work and any necessary repairs of agricultural implements. In some provinces it was the general thing in former times, in the long winter-evenings, when no outdoor work was

possible, for the men to devote their attention to some form of handiwork, or "sloyd", such as the making of wooden shoes, chairs, baskets, and other domestic utensils, just as the women spent such time in spinning and weaving.

This **carpentry** was facilitated by the plentiful supply of cheap wood, oak, birch, alder, and white-wood. By degrees, this domestic industry has given place to an extensive manufacturing industry, inasmuch as factories have been established in many places for the manufacture of common furniture and of the wooden fittings of houses, such as doors, window-frames, etc. One product of this industry that has found a not inconsiderable market abroad, especially in warm countries with a poor supply of native timber, are complete *houses of wood,* a market for which, especially as summer residences, is also found in Sweden itself.

In the furniture- and wooden-house industry, the same improved taste can be remarked that has been in evidence in architecture and art-industry generally during the last twenty years.

The **export** of joiner's work proper, in 1912, amounted to 13 935 000 kronor, in addition to planed deals, packing-case material, staves, etc., to a value of 38·9 million kronor. Of the first-named, the exports to England amounted to 7 716 000 kronor; to Russia 2 263 000 and to Denmark 641 000 kronor, etc.

Joinery work and furniture-making flourish best in Jönköping Län, after which come the Läns of Kalmar, Östergötland, Göteborg och Bohus, Södermanland and the city and Län of Stockholm. Among the largest joinery-factories may be mentioned: *Åtvidabergs snickerifabrik* (Snickerifabrik = joinery-factory), Åtvidaberg; *Stegeholms Snickerifabrik,* Västervik, and *Carl Fredrikssons Träförädlingsaktiebolag,* Katrineholm.

In 1912, there were in Sweden 565 joinery- and furniture-factories, employing a total of 10 464 hands and turning out goods to a value of 30 830 000 kronor. These figures, however, do not include the joinery-factories turning out machines, which are 33 in number, employ 779 hands and manufacture goods to a value of 1 633 000 kronor. In Swedish statistics, these last-named factories are included in the Machines and Implements group.

Other Manufactures.

Cooperies. In some industries, the demand for bulging casks, such as kegs and drittles, is very considerable; for example, in the butter and margarine-, snuff-, cement-, herring-, spirit-, and soap trades, etc., and, in our own days, this want is supplied by factory-made goods. The largest cask-factories are the *Uddevalla Tunnfabriks- och Trävaruaktiebolag* at Uddevalla, whose output, however, depends very much on the annual catch of herring, and the *Åstorps Tunnfabrik* in Kristianstad Län.

In the whole of Sweden there were, in 1912, 38 cooperies and drittle-factories, employing 422 hands and producing goods to a value of 1 521 000 kronor.

Wooden shoes are either made entirely of wood, preferably of alder, being then a very warm, dry, and also cheap foot-wear, or else they are made of leather, in the form of half-slippers on a wooden sole. Such wooden slippers are more easily made in factories than are wooden shoes proper. The manufacture of wooden shoes is mostly carried on in the Läns of Jönköping, Kronoberg, and Kristianstad. In 1912 there were, altogether, 45 wooden shoe- and last-factories, employing 400 hands and with an output amounting to 1 220 000 kronor.

Chip-boxes form the object of a large manufacture, and are made in millions for the match-factories. The number of factories in 1912, which carried on this business exclusively, amounted to 6, with 170 hands and an output valued at 588 000 kronor.

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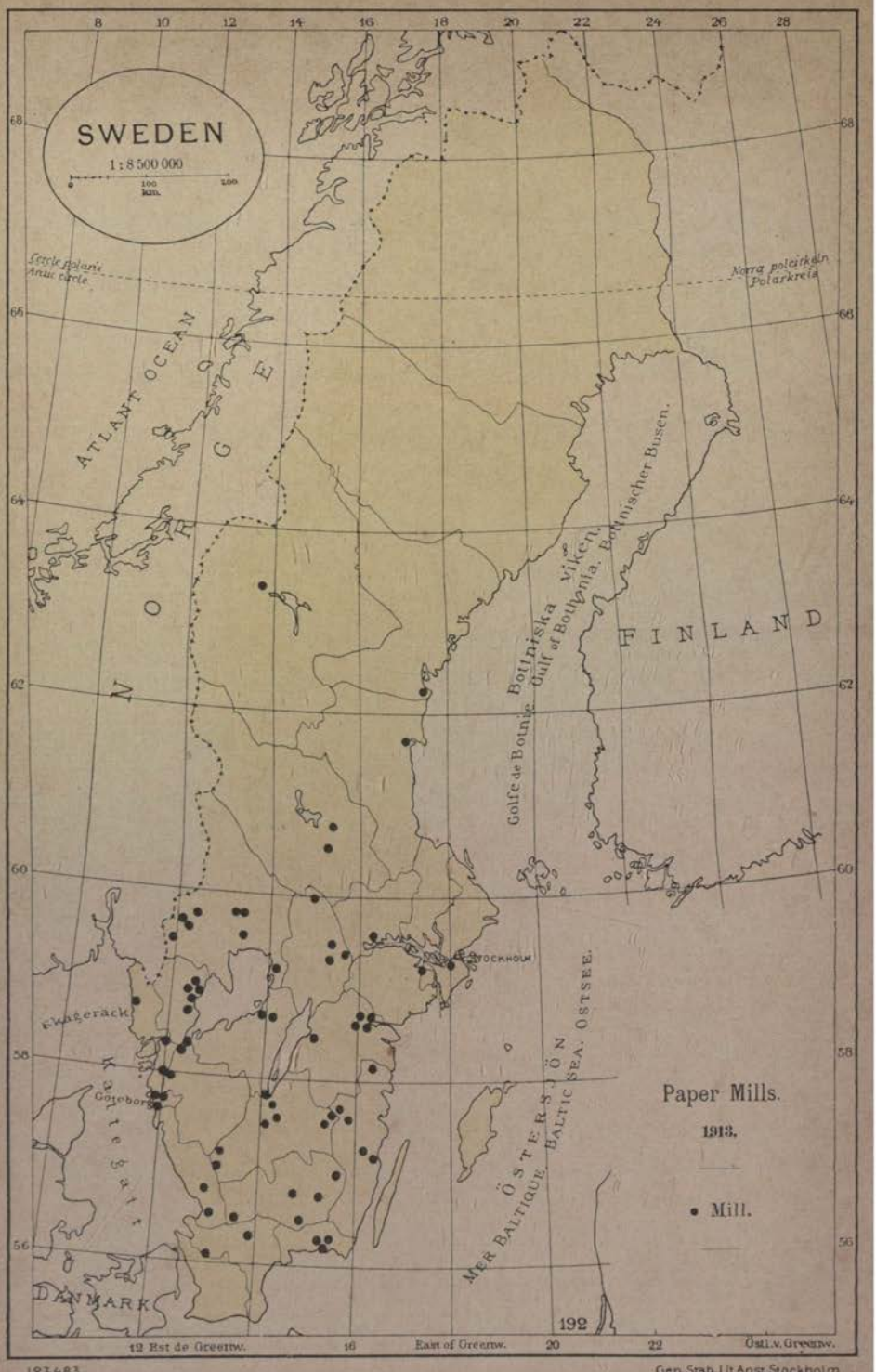
6. PAPER INDUSTRY.

Of such mills in operation in 1912, 73 were engaged in the manufacture of paper and pasteboard, and 171 manufactured other commodities within the same branch of industry. The numbers of employees were respectively 8 609 and 4 441, and the total values of the finished products were respectively 64 139 329 kronor and 13 796 229 kronor. The import and export — especially the latter — of paper is considerable; for particulars see below. The total value of the imports for 1912 was 3 590 518 kronor, and of the exports, 40 352 319 kronor. Hence this industry is one of those that tend considerably to improve the balance of trade in Sweden.

Paper Mills.

The Swedish paper industry dates back to the 16th century. The oldest paper mills in the country are the Klippan mills, which were probably founded in 1573. Of other still flourishing paper mills the oldest are the Lessebo mills, which were erected during the decade 1661—70 and were granted their privileges as paper mills in 1719; Grycksbo mills, established by J. Munktell in 1740; and Gransholm mills, established about 1790. At these mills, as also at a number of smaller establishments the paper was made by hand until 1832, when machinery was introduced at the Klippan mills, upon which the Lessebo and Grycksbo mills followed suit in 1836. The chief productions of the above-named manufactories comprise chiefly better quality **printing-** and **writing-paper**; Grycksbo mills also produce **wrapping-paper** and **filterpaper,** which last has enjoyed a high reputation ever since the time of Berzelius. **Bank note paper** and **stamped paper** are made at the *Tumba* mills (established 1758), belonging to the Bank of Sweden.



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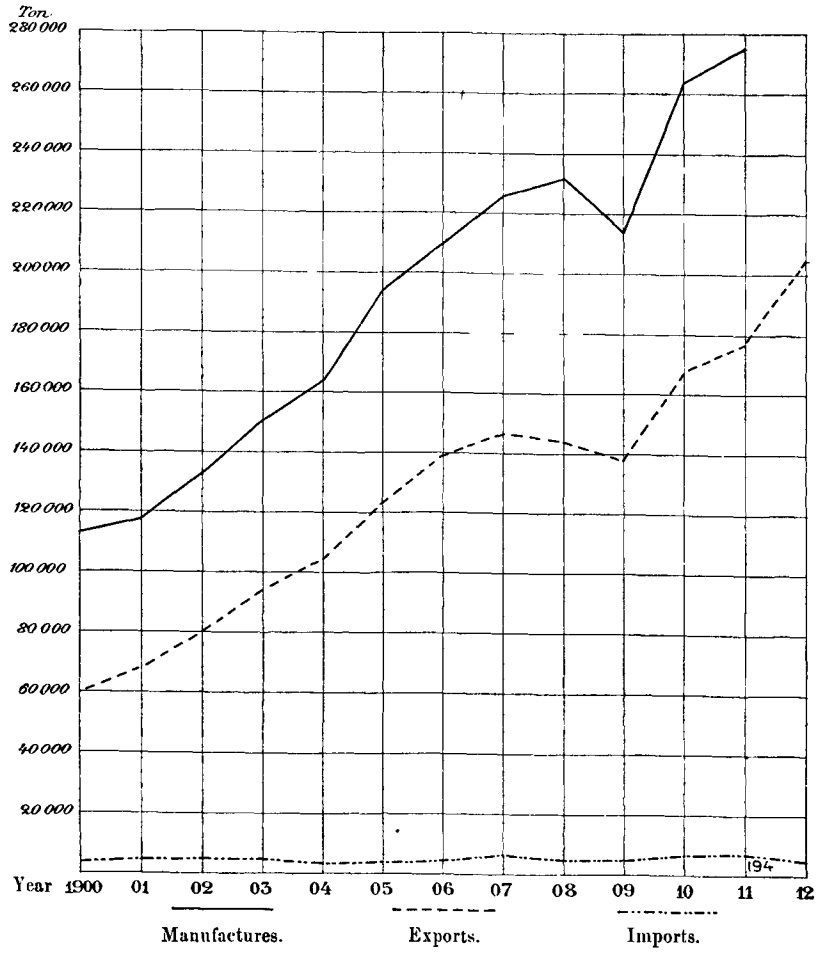
Manufactures, Imports and Exports of Paper and Cardboard.



During the period 1861—80, was begun the manufacture of **sheathing-paper,** chiefly for building purposes, and this industry is pursued on a large scale at Munksjö (1862), Vargön (1869), Katrinefors (1871), Munkedal (1872) and Fiskeby (1873).

The development of the paper industry during the last thirty years has shown a pronounced tendency towards specialization, especially in the manufacture of **newspaper paper,** as at Holmen in Norrköping, where are to be found the machines for producing the broadest paper turned out in the country, at Lilla Edet, and at the great mills at Domnarvet (1900); another speciality is **wrapping paper,** manufactured, among other places, at Strömsnäs mills (1896), Frövifors mills (1901), and Örebro mills (1901). Furthermore, a number of the older mills have been rebuilt or extended, in order to develope one or other, or both, of these branches.

The materials used in the manufacture of the better qualities of writing and printing paper are, apart from rags, bleached sulphite- and sulphate-pulp, small quantities of imported cellulose, aspen-tree pulp, straw-pulp, and esparto-pulp. For the manufacture of pasteboard is used white or brown mechanical pulp, often with a slight addition of cellulose, except for roofing-board, which is made exclusively from rags. The Swedish wrapping paper — with the exception of the so-called Havanna paper, made from boiled mechanical pulp — is produced mainly from sulphite- or sulphate-cellulose.

As the Swedish manufactories generally work with their own half-manufactured material, cellulose and mechanical pulp, and thus with comparatively cheap raw material, they might be expected to be in a stronger position in the world's markets than they now are. In point of fact, the sudden advance (indicated above) of the Swedish wood-pulp industry has not proved an unmixed advantage to the paper industry, since it has enabled the exporters to supply foreign producers with low-priced half-manufactured materials.

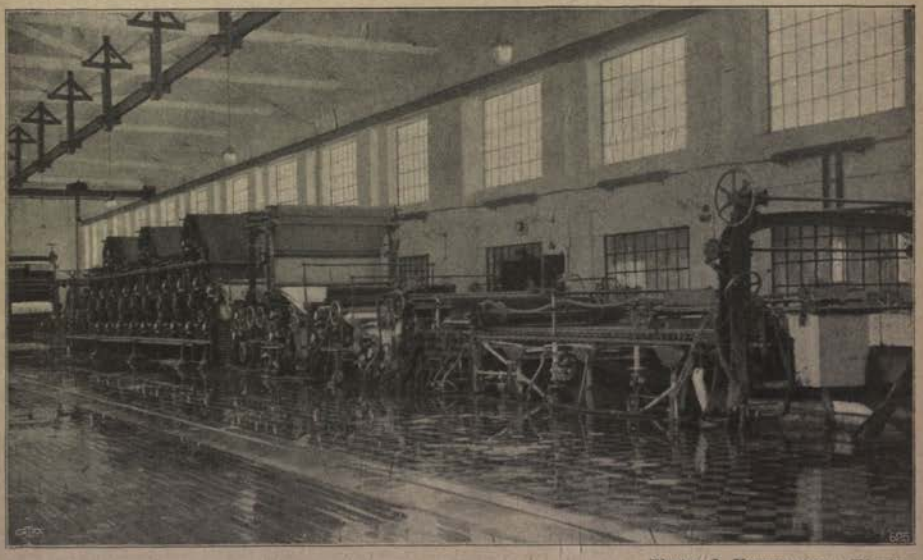


Photo. J. VESTERGREN, Tumba.

Paper-making Machine, Lessebo.

The development of the Swedish paper industry since the year 1866 is shown by the following table:

Annually	Mills	Employees	Manufactures value in kronor	Imports quintals	Exports quintals
1866—70	63	1 861	4 005 000	1 999	12 881
1871—75	53	2 329	6 419 000	9 600	25 811
1876—80	50	2 442	7 217 000	13 703	62 761
1881—85	41	2 917	7 899 000	15 313	78 482
1886—90	37	3 078	8 819 000	23 155	135 381
1891—95	54	4 579	12 084 000	39 429	244 255
1896—00	59	5 209	18 280 000	54 952	425 907
1901—05	67	6 931	30 318 000	44 450	922 966
1906—10	69	7 829	46 666 000	58 435	1 459 614

Annually	Mills	Employees	Manufactures value in kronor	Imports quintals	Exports quintals
1910	70	8 100	53 886 000	67 890	1 664 880
1911	69	8 216	57 069 000	74 828	1 760 408
1912	73	8 609	64 139 000	59 683	2 037 017

The official statistics for 1911[1] afford the following details as to the *manufactures, exports* and *imports:*

	Manufactures quintals	Imports quintals	Exports quintals
Burnishing and emery paper	1 864	1 783	601
Packing paper etc.	1 241 556	1 304	445 806
Letter, writing, printing paper etc.	1 109 719	31 986	1 105 857
Other kinds of paper	58 000	1 153	42
Card-board used in building	124 504	37 584	13 477
Other kinds of board	218 857	1 018	194 625

The manufactures, imports and exports during 1900—12 are also indicated by the following graphs, which have been based upon particulars obtained chiefly from Svenska cellulosaföreningen.

While, during the last 12 years, the imports have not shown any great increase, the exports have more than trebled. Paper, like wood-pulp, is one of the most important articles of Swedish export.

Apart from insignificant quantities of wrapping paper, intended for special uses, such as straw waste paper, the paper imported chiefly comprises various sorts of more valuable paper, which are not made in Sweden, and of which only small quantities are used. The exports, on the other hand, include two great groups: newspaper paper (63 000 tons, of the value of 9·78 million kronor), and fine and coarse wrapping paper (98 000 tons, of the value of 20·19 million kronor).

7. MANUFACTURES FROM VARIOUS VEGETABLE MATERIALS.

In 1912 there were in Sweden 31 factories engaged in the manufacture of such goods, employing in all 731 hands and with an output amounting to 2 664 000 kronor. The most important article under this category is *cork. Aktiebolaget Wikanders Korkfabrik,* in Stockholm, which also owns *Göteborgs Korkfabrik,* Gothenburg, is of European importance in its branch, possessing as it does large branch-establishments at Åbo, Helsingfors, Riga, Libau and Odessa, with a total output of 25 million kronor. The output in Sweden is estimated at a value of more than 2 million kronor per annum. Altogether there were in 1912 a total of 14 cork-

[1] For 1912 the detailed figures for the manufactures, on the one hand, and the imports and exports, on the other, are not comparable, for which reason the particulars for 1911 are given, since they are more satisfactorily comparable.

factories in Sweden, employing 425 hands and with an output of a value of 2 050 000 kronor. The imports, however, in 1912, amounted to 1 612 430 kronor for cork-bark, and 68 430 kronor for cut-corks, while the export of cut-corks amounted to 209 800 kronor.

There are in Sweden 11 **basket-factories** with 233 hands, the value of the manufactures amounting to 511 700 kronor. In 1912 the imports amounted to 273 185 kronor and the exports to 307 845 kronor, thus showing an inconsiderable excess of exports.

8. MANUFACTURES OF STONE, CLAY, COAL, CHARCOAL, AND PEAT.

This important branch of industry includes the following main subdivisions (the figures refer to 1912):

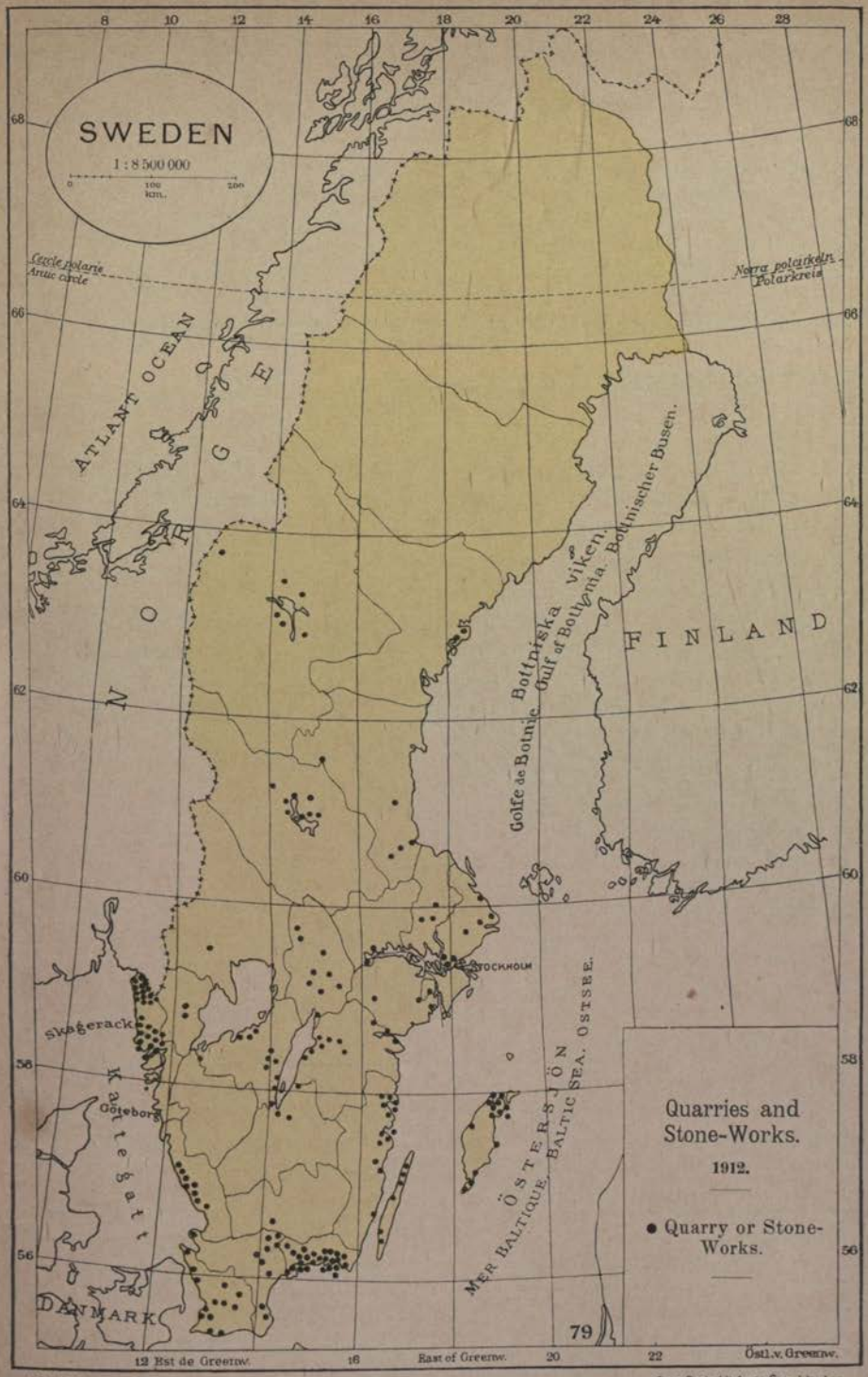
	Factories	Workmen	Value of production kronor
Stone and Clay manufactures	965	31 980	63 225 000
Glass, and Glass manufactures . . .	70	5 278	12 364 000
Products of Coal Charcoal and Peat .	626	11 107	28 949 000
Total	**1 661**	**48 365**	**104 538 000**

This branch is closely allied to the mining industries, and many data concerning it will be found under the said heading. Thus, on p. 240 figures are given with reference to the large imports of raw materials for the manufactures here concerned; for instance, of coal used directly as fuel and indirectly in gasworks for the production of lighting-gas. The exports of raw materials are also considerable; the total value of the exports is given on page 240. As regards the special items, cf. the following articles.

Stone Industry.

Sweden's great wealth in different varieties of stone that can be employed industrially for building purposes, for decoration, etc., has given rise to an industry on a large scale, which, during the last few decades especially, has advanced with great rapidity and, all appearance, has every prospect of still greater development.

Even during the earliest period of the historic era of the country — the 12th and 13th centuries — may be traced the first beginnings of a stone-industry, which was not restricted to the employment of this material within the country exclusively, but which also enjoyed a probably not unimportant export. Of course, the varieties of stone which, at that period, were most made use of — chiefly for church buildings and the like — were those which could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be most easily dressed, viz., *limestone* and *sandstone*, though for the erection of fortresses, castles etc., the harder kinds of stone were also employed.

During the 16th century, there were erected a great number of buildings in limestone and sandstone. Still livelier did this architectural activity become during the following century, especially after the close of the 30 Years' War, when the great captains, on their return home, had stately mansions and castles erected in Stockholm and in the country. For the majority of these buildings, *granite* began to be more widely employed.

In the middle of the 18th century a change was made, *brick* becoming the sole building material, and this so exclusively that not only granite, but also those kinds of stone that can more easily be worked were completely neglected.

For nearly a century, granite, as a building material, was almost forgotten. The construction of canals during the first part of the 19th century, however, once more directed public attention to this kind of stone, as being that which was most suitable for works of this and similar kinds. It was, most certainly, the experience he gained of the excellent qualities of granite as a building stone that led Nils Ericson to establish stone-works in Malmön, near Lysekil.

The Malmön stone-cutting and stone-polishing works soon found imitators in Bohuslän, Halland, Blekinge, Småland, Östergötland, and, later on, in Skåne, the latter province being the chief seat of production of the beautiful and valuable "*black granite*" (diabase) in Sweden.[1]

Bohuslän granite, from its beautiful colour and fine grain, is now used on an extremely large scale both for constructional and ornamental work, not only in Sweden, but also abroad, and especially in Denmark, Germany, and Great Britain.

Of the granites in Småland, the beautiful red stone from Virbo, Uthammar, and Vånevik, have been exported in undressed blocks to Germany, Scotland and England, where it is employed for monuments, pedestals, etc.

From the Älvdal porphyry works, which were established in 1778, there issued during the course of nearly a century, numerous productions executed in this magnificent and richly coloured stone, which came into well-deserved demand, both at home and abroad. The articles produced by means of the remarkable and ingenious machinery that was employed for the treatment and polishing of the hard porphyry were mostly ornamental in character, such as urns, vases, candlesticks, letter-presses, brooches, buttons, etc.

Potstone, from Handöl in Jämtland, has long been quarried and worked up, chiefly for stoves, small domestic vessels, and decorative objects.

Clay-slate is chiefly used for making roofing-slates. It is quarried at Grythyttehed, in Västmanland, and at Hällan and Haläugen, in Dalsland.

Sandstone is one of the most important building-stones found in Sweden, this being due to the relative ease with which it can be quarried and dressed, and also to its power of resistance to weathering. Its chief varieties are the following:

Gävle sandstone, quarried at a good many places between Gävle and Storvik. South and south-east of Gävle there occur masses of sandstone-block, the so-called *Roslag sandstone*, which has been much employed for buildings in Stockholm, in both earlier and more recent styles.

Öved sandstone, from Skåne, with its fine grain and its warm red colour, has come greatly into use of late.

Gottland sandstone, which was much used in earlier times for the adornment of all the churches in the island.

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[1] "Black granite" is a technical and not any petrographical term. It includes the following rocks: diabase, diorite, hyperite, and gabbro.

At the foot of the Västgöta Hills there exists sandstone, which is quarried at Kinnekulle, Billingen, Lugnås, etc. In this group there is also included the Närke sandstone, which is quarried at Sjötorp, east of Örebro, and at other places.

Dala sandstone, which is found over a large area between the eastern and the western branches of the river Dalälven.

At Simrishamn, and in Runnö in Kalmar Sound, there is found a sandstone that is employed for making grindstones.

Limestones and marble. Among the most important of the limestones of Sweden, special mention must be made of the *Kolmård marble*, whose greenish tinge, caused by the serpentine existing in this variety, makes it an extremely original variety and one, we venture to think, almost unique amongst the many kinds of marble. Kolmård marble is nowadays no longer used for exterior architecture, as it has proved to be too sensitive to weathering. The marble, however, is a first-class raw material for interior facings, for columns, wall-facings and floorslabs, etc., and, when polished, especially in combination with bronze, has a singularly beautiful effect. In addition, Kolmård marble has from early times been employed for making many kinds of large and small decorative articles.

The Lower Silurian, close-grained limestones of Sweden have also been employed on a large scale in both early and recent times. It is found in Skåne, Öland, and the more northerly läns.

The Upper Silurian limestones are found in Gottland and in Skåne. At present they are quarried on a large scale north of Visby.

The comparative statistics issued by the statistical branch of the Board of Trade supply further information respecting the development and extent of the Swedish stone industry. The figures given are, however, very incomplete for the first few years of issue, as only very few and incomplete reports were received from stone-works and stone-polishing works. The following figures are taken from the statistics mentioned:

Year	Stone works	No. of hands	Value of output kr.
1865	4	211	101 000
1880	22	1 737	641 000
1890	43	1 912	1 213 000
1895	124	6 379	4 411 000
1900	228	11 697	11 063 000
1905	299	12 346	13 647 000
1910	347	13 815	19 251 000
1911	357	13 913	19 534 000
1912	359	13 925	20 173 000

Of the total value of the output of stone for 1912, that of Göteborg och Bohus län amounted to 8 347 000 kronor, or, approximately, 41 % of the whole. Then come, in the order given: the Läns of Blekinge, Kristianstad, Malmöhus, and Kalmar.

Felspar. From the 46 felspar quarries worked during 1911 there were obtained, according to the report sent in — which, however, must be considered as rather incomplete — 34 300 tons of a stated value of 333 000 kronor, which, on an average, makes about 10 kronor per ton.

Quartz. In 1912 there were quarried 22 400 tons of quartz, with a stated value of 103 000 kronor.

The great development of the stone industry during the last decade of the 19th century was, it is true, the result in some measure of an essential increase in the employment of undressed varieties of stone, for various purposes within the

TABLE 90. *Stone Export.* Value in kronor.

Annually	To Germany	To Denmark	To Great Britain	To other countries	Total
1890	2 603 029	597 365	278 803	205 071	**3 684 268**
1895	4 299 328	376 238	273 825	311 729	**5 261 120**
1900	7 553 249	1 402 764	855 961	575 414	**10 387 388**
1905	9 333 163	1 122 267	1 135 561	1 273 352	**12 864 343**
1910	7 472 086	1 036 943	941 082	3 510 826	**12 960 937**
1911	8 213 908	1 239 896	821 876	3 691 856	**[1]13 967 536**
1912	8 343 561	1 225 348	686 398	3 876 703	**[2]14 132 000**
1913	.	.	.	.	**[3]16 083 000**

[1] Felspar and quartz to a value of 741 444 kr. not included.
[2] » » » » » » » 757 000 » » »
[3] » » » » » » » 866 000 » » »

country, but it chiefly results from the fact that the stone in question received its final preparation in the foreign market, where it was employed on a steadily increasing scale, chiefly in Germany. At the present day, Sweden is one of the principal stone-exporting countries in the world. Apart from the fluctuations of the market during the last few years, the value of the Swedish stone-export has, on the whole, increased, as is seen by Table 90.

* * *

With respect to a number of geological questions connected with the stone industry, the reader is referred to the article on the geology of Sweden, where it has been considered advisable to give also some fairly detailed information respecting the employment of the various classes of stone.

Cement and Mortar.

The manufacture of cement in the form known as Portland cement is not of very old date in Sweden, though a sort of hydraulic mortar, made of burnt alum shale powder and lime, was formerly used in connection with earlier canal structures. Cement was employed as early as 1860 but then only to the extent of 1 180 tons. The first cement factory in Sweden was established at Lomma in Skåne in 1871, on the initiative of professor *Otto Torell* and *Otto Fahnehjelm*, an engineer. Clay of suitable quality is to be found there in unlimited quantity, and lime was obtained from the neighbouring place of Limhamn and sent by sea to Lomma. This was the beginning of the Scanian Cement Company (Skånska cementaktiebolaget), the first manager of which, *R. F. Berg*, has done a great deal towards furthering the development of the cement industry in Sweden. In Sweden the natural conditions necessary for the manufacture of cement are amply satisfied, owing to the great resources of suitable raw material, and, after the Lomma factory (which was closed in 1904) other factories were started at Limhamn (established by the Scanian Cement Company), Visby 1885, Öland 1888, Hällekis 1892, and at Klagshamn and Maltesholm 1898. The latest factory is the Ifö Cement Factory (1909). The sale of the products

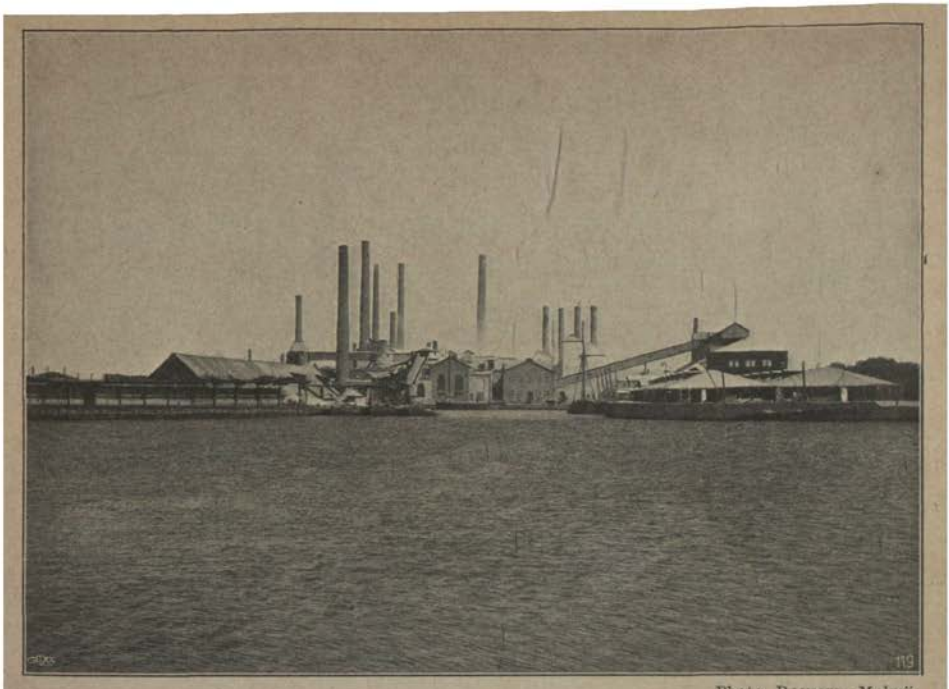


Photo. ROIKJER, Malmö.

Cement Factory at Limhamn (Skånska Cementaktiebolaget).

of all these factories is negotiated through the Svenska cementförsäljningsaktiebolaget (Swedish Cement Selling Co.) of Malmö. Owing to its excellence, this Swedish cement has obtained a first class reputation, also for export, at first under the name of *lommacement*. The output of the factory at Lomma was at first 20 000 casks of Cement yearly. The capacity of production of the Limhamn factory is now about 900 000 casks yearly. When working at full pressure, all the Swedish factories can now produce about $2^1/_2$ million casks yearly. The product was 339 618 tons

TABLE 91. *Cement Industry.*

Annually (Altered statistics from 1896)	Value of production kr.	Imports kr.	Exports kr.	Consumption kr.
1875	221 000	265 000	119 000	367 000
1876—80	398 000	285 000	204 000	479 000
1881—85	634 000	328 000	332 000	630 000
1886—90	1 063 000	360 000	310 000	1 113 000
1891—95	1 829 000	69 000	971 000	927 000
1896—00	3 322 000	67 800	914 700	2 475 100
1901—05	3 849 500	260 000	662 000	3 447 500
1906—10	6 834 100	373 500	1 042 200	6 154 400
1910	8 480 000	691 000	2 392 000	6 779 000
1911	8 344 600	636 900	2 390 400	6 591 100
1912	9 621 000	436 000	3 369 000	6 688 000

(1 187 000 casks) in 1912, with a value of 9 621 000 kronor. 1 447 workmen vere then employed in the manufacture of cement. With the year 1889 when cement became subject to a duty of 40 öre per 100 kg the manufacture rose somewhat, and later increased rapidly when the duty was in 1895 increased to 60 öre per 100 kg; the manufacture and export have steadily increased since.

The development of the cement industry and the consumption in Sweden since 1875 is shown in Table 91.

Of the total export in 1912, amounting to 127 141 tons, 42 420 tons went to Russia, 33 286 tons to the Argentine, 22 155 tons to the Sunda Islands, 14 810 tons to Finland, and 12 189 tons to Denmark; the remainder was distributed over British South Africa and Brazil.

The consumption of Portland cement has shown a rapid increase and it is now just as necessary as mortar in all branches of building, both on land and water. The result has been that a number of *cement foundries* have been erected. In the year 1912, their number was 60, with 1 067 workmen and an output value of 4 394 000 kronor. The oldest and largest of them is Aktiebolaget Skånska cementgjuteriet (The Scanian Cement Foundry, Ltd), with branches in many places in the kingdom.

There is also a considerable manufacture of *mortar*. In 1912 there were 11 factories at work, with 199 workmen and a production to the value of 1 082 000 kronor.

Earthenware.

The raw materials employed in the manufacture of earthenware are clay, sand, felspar, quartz, chalk, etc.

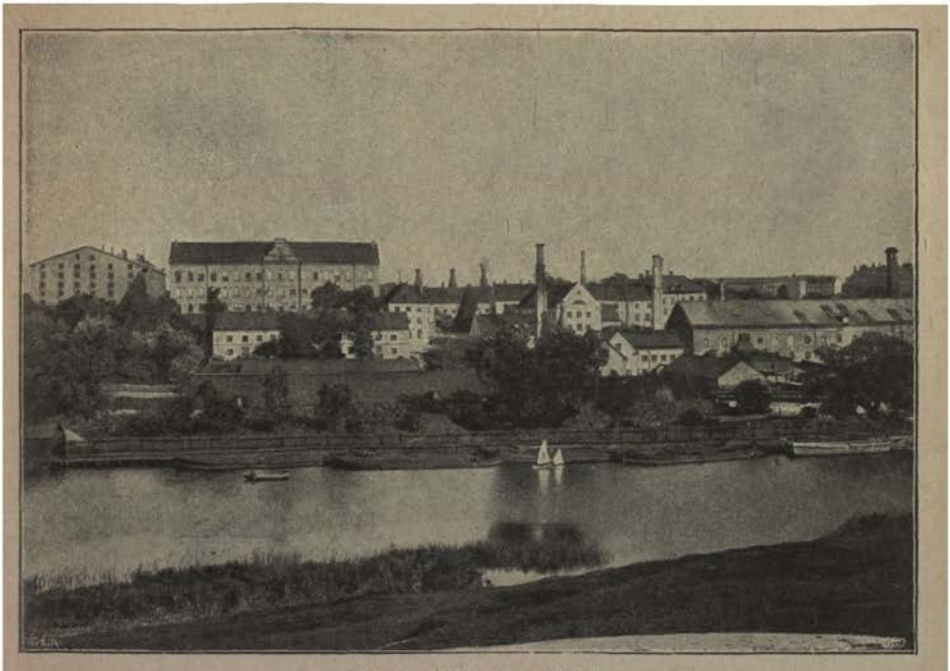
Clay and sand are used for *making bricks*. The various kinds of clay have different consistencies and qualities. The principal difference between heavy and light clay is that the former is less mouldable, the latter more so (plastic). The Swedish clay is generally too heavy for making bricks, for which reason sand is added and the mixture must be prepared with water, shaped, and burnt.

Clay was formerly shaped by hand, dried in the open air and in open drying-houses, and burnt in furnaces heated with wood. Hand-labour is not yet altogether a method of the past, since bricks made in this fashion are considered to be as durable as machine-made goods, but the adoption of machines for the shaping of bricks can now be considered as being general.

The system of baking bricks has also been modernized through the introduction of annular kilns, which burn continuously, instead of the old simple kilns, which were heated with wood at intervals. In ancient times so-called field-baking was employed.

The production in 1912 at Sweden's 363 brickyards and earthenware factories amounted to 366 146 000 clinker, wall-, roof- flint-, limesand, quartz and ash-

bricks; 33 914 000 pipes and parts of piping, 165 570 tons of fireproof, facade, revetting and stack bricks, also fire-clay and a number of other brick and clay wares to a total value of 15 620 000 kr. The manufacture of tiles is greatest in Malmöhus Län, which produced bricks and earthenware to a value of 5 576 000 kr. or about 36 % of the whole. Next comes Kristianstad Län with 1 385 000 and then Stockholm Län with 1 330 000 kr. and Älvsborg Län with 1 055 000 kr. The export of crockery amounted in 1912 to 156 668 tons and rose in 1913 to 159 903 tons.



Rörstrand Pottery-Works.

Fireproof clay. In the carboniferous formation of Skåne occur alternate strata of coal, fireproof clay, and slate clay. Many different articles are made from these wares, such as bricks, pipes, vessels of different kinds, ornamental articles, etc. The manufacture of fireproof bricks was commenced at the factory at *Höganäs* in 1827, and now more than 12 million bricks are turned out every year. Several buildings have been erected for this industry. The manufacture of clay vessels was begun in 1833; at first only unglazed vessels or those with lead glaze, yellow in colour were produced. In 1835 the brown salt-glazed ware was introduced. The manufacture of pipes commenced in 1869, and there are now two large pipe factories. Drain pipes, cribs troughs, chimneys etc. are also made. At the works for ash-brick, for which the demand becomes greater every year, are made air-dried building bricks, the composition of which is $^4/_5$ ash and $^1/_5$ lime.

In 1903 Höganäs stenkolsbolag amalgamated with Billesholms—Bjuvs aktiebolag under the style of Höganäs—Billeholms aktiebolag. The manufacture of fire-

proof products is carried on at many manufactories in Skåne. The following were manufactured from clay and slate in 1912:

Fireproof products	88 937 tons	of the value of 1 665 000 kr.
Klinker »	» »	» 1 849 000 »
	Total sum	**3 514 000** kr.

The export of fireproof clay in 1912 was 37 922 tons and rose in 1913 to 40 530 tons.

Workshop for Hand-pressing, Gustavsberg.

Pottery.

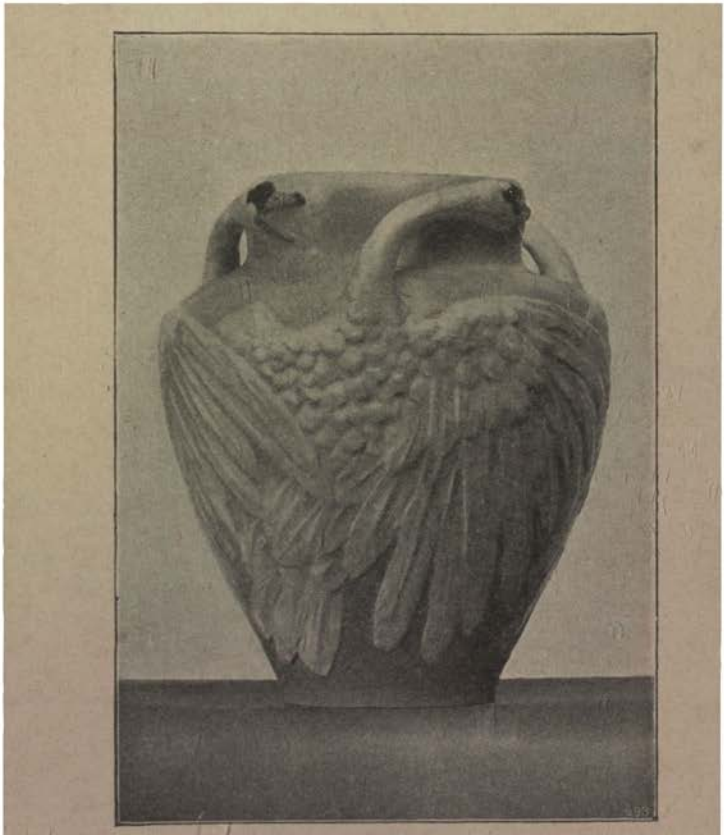
In Sweden earthenware and china have long been produced and since 1911 at five large factories. There also exist a great number of small works for the manufacture of stoves and crockery. *Rörstrands fabrik* (present proprietors *Rörstrands fabriksaktiebolag)* is the oldest factory and is situated in Stockholm. It was founded in 1726 and up to the beginning of 1800 produced Delftfaience. In 1782 Rörstrand bought the Marieberg factory, built in 1758 and closed down in 1788. These two works made ware for domestic use, tiles for stoves, and fancy articles, all made of red Uppsala-clay, covered with thick tin glaze. In 1820 the manufacture of Wedgwood's "Queen's ware", made of white clays and flint and covered with transparent glazes, was introduced at Rörstrand, but the results were not satisfactory before 1850. — In the year 1827, the *Gustavsberg* factory was established at Värmdön (present proprietors

Specimen of Rörstrand Pottery.
Vase in majolica, 7 feet high.

Aktiebolaget Gustavsbergs fabriks intressenter), and during the thirties and forties the same articles were produced there as at Rörstrand. Between 1850 and 1860, energetic efforts were made to develop and modernize the factories, and although they have both continued to make domestic ware and dinner services of earthenware and china, they have each introduced special lines of their own. Thus *Rörstrand* has turned out ornamental tile stoves of majolica, insulators, and other articles for electrical use of felspar china, besides exquisite art-ware with underglaze-decorations of felspar

and bone china. *Gustavsberg* makes beautiful articles of Parian-porcelain, usually reproductions of well-known sculptures, jasper-ware, and serafittoworks in delicate colours. During recent years both firms commenced the manufacture of sanitary ware.

In 1898—99 a new earthenware-factory (proprietors *Aktiebolaget Göteborgs porslinsfabrik*) was built at Hisingen in Gothenburg. This factory has in a few years succeded in making ware of good quality and all kinds of articles for domestic use, and it enjoys a good reputation. In 1913 the factory was bought by Rörstrand.



Specimen of Rörstrand Pottery.
Vase of Felspar-China underglazepainted.

In the town of Gävle a stove factory closed down in 1910, and it then was rebuilt as an earthernware-factory (proprietors *Gävle porslinsfabriksaktiebolag*), and in Lidköping works were started in 1911 for making felspar-china (proprietors *Aktiebolaget Lidköpings porslinsfabrik*). The productions of these factories are rather too new to the market for a verdict as to their quality to be given.

The raw materials used in the Swedish factories are largely imported

TABLE 92. *Production, Imports, Exports of China and Earthenware.*

Annually	Factories	Workmen	Production kr.	Imports kr.		Exports kr.	
				China	Earthenware	China	Earthenware
1861—65	2	524	945 000	195 000	132 000	350	1 800
1866—70	2	576	1 018 000	132 000	76 000	4 200	18 800
1871—75	3	996	2 093 000	199 000	96 000	2 600	44 000
1876—80	2	1 032	1 767 000	216 000	105 000	7 600	60 000
1881—85	2	1 421	2 445 000	245 000	243 000	17 000	186 000
1886—90	2	1 559	2 538 000	331 000	325 000	76 000	475 000
1891—95	2	1 539	2 734 000	652 000	369 000	73 000	394 000
1896—00	4	1 823	3 242 000	924 000	379 000	89 000	146 000
1901—05	6	1 945	3 568 000	990 000	386 000	10 000	64 000
1906—10	6	2 142	4 532 000	593 000	611 000	19 000	100 000
1910	7	2 147	4 821 000	418 000	806 000	19 000	177 000
1911	7	2 209	4 757 000	422 000	911 000	15 000	204 000
1912	8	2 550	5 306 000	424 000	891 000	12 000	236 000
1913	.	.	.	542 000	1 432 000	17 000	228 000

from England, where the greatest supplies of good clay are found, and from where also the coal for the kilns are obtained. From Scania (Skåne) in the south of Sweden a good deal of excellent fireclay is taken. Felspar and quartz are also found in Sweden itself, but most of the flint is obtained from Denmark and France.

Swedish china enjoys a high artistic reputation and is exported in large quantities, and the earthernware produced in Sweden is of the best.

The above figures testify to the increase in the use of china and earthenware in Sweden which has taken place in the last forty years. At the same time as the home manufacture has increased considerably, the import of foreign goods has also risen and the home manufactures have to face this steady competition. The difficulty in competing with the import trade is caused by the lower prices at which the foreign goods often are sold, which is due to the specializing in the manufacture possible in a country with a large population, partly to the variety of models and patterns which are offered from abroad. The foreign manufactories often resort to the dumping system and flood Sweden with the surplus of their manufactures at sale prices.

Sweden's export has, however, risen during the last decade, although, unfortunately, it cannot be compared with the imports. The export of earthenware goes chiefly to Norway and Denmark, whilst the export of better and finer goods, chiefly of china, are disposed of on the continent and in America.

Tile Stoves and Crockery.

The first **tile stoves** in the country were made in the south of Sweden in the fifteenth century, from where the manufacture gradually extended to other parts of the country. Further particulars as to the history of this industry are wanting until the seventeenth century, when the manufacture was carried on both at *Rörstrand* and *Marieberg*. The material used at that period for the production of tiles was plastic

stratified clay-marl; the best clay has long been found in the neighbourhood of Uppsala.

The manufacture of tiles in Stockholm was considerably developed by A. J. Westman between 1840 and 1850, and also later by O. H. Åkerlind; new methods, copied from earthenware factories, were introduced, and also an opaque lead-tin oxide glaze, far superior to what had been hitherto used, was produced.

In the year 1857, at Rörstrand, where the old manufacture of tiles had ceased at the end of the 17th century, was started the industry of making tile-stoves of white faïence with transparent glaze, and in the beginning of the seventies, majolica fireplaces and other large stoves, decorated profusely with enamel, were introduced; these served later as models for many firms in Sweden.

Among the great tile stove manufactories may be mentioned *Rörstrands fabrik* in Stockholm, *Uppsala-Ekeby aktiebolag, Boivies kakelfabriksaktiebolag, Uppsala kakelfabrik,* and *S:t Eriks lervarufabriker,* all in Uppsala, *Sandbäck* in Kalmar, *Östbergs kakelfabrik* in Örebro, *Aktiebolaget Svenska kakelfabriken,* Örebro, *Oskarshamns kakelfabrik, Karlskrona kakelfabrik, Arbrå kakelfabrik, Skattkärrs kakelfabrik,* etc.

During the eighties and nineties, the manufacture of tiles made rapid strides, and tile stoves and crockery were produced at some 60 works, to the value of 1 ¾—2 million kronor yearly. During the last few decades, however, the trade has encountered great difficulties, and a number of factories have been closed, owing, in the first place, to the ever-increasing competition from calorifères, and also to the change in taste in favour of simple white tile stoves.

At many tile and brick factories, as at several small **crockery works** in Sweden, a considerable quantity of unglazed flower pots and dishes of ordinary plastic red-clay are produced, and also glazed pottery and crockery. These are often decorated with various-coloured fluted glaze, which gives a good effect.

As has been mentioned above, a very important trade in crockery and a large export trade is carried on in Skåne. Besides the manufacture of bricks, paving stones, and drain-pipes of fire-proof clay, there is also a large production of salt-glazed jugs and fancy articles in majolica glaze.

Lime.

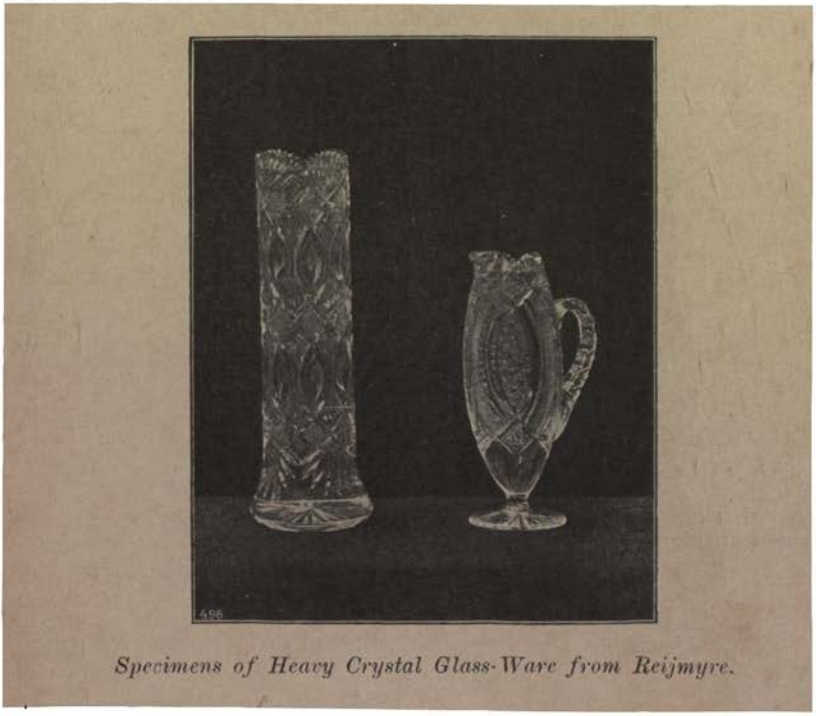
Several geological formations, for instance the primary formation, the Silurian, the Cambrian, and the chalk formation, yield the raw material necessary for the production by industrial means of carbonate of lime. At limeworks, limestone is burned to form quicklime; at chalkworks, loose chalk in its natural state is washed and purified.

Limeworks are found in 16 of the läns in the country. The largest number are in the Län of Skaraborg; after that come the Läns of Örebro,

Kopparberg and Kristianstad. In 1912 there were 88 limeworks, emploing 1 773 hands. The output amounted to 4 244 857 hectoliters, valued at 4 009 247 kronor. The number of chalkworks was 10 employing 118 workmen and with an output of 184 480 quintals, valued at 398 000 kronor.

In 1913 there were imports to Sweden of 1 058 tons of lime, to a value of 19 900 kronor; the imports of chalk were 60 260 kronor. In the same year there were exports of 12 334 tons of lime to a value of 242 000 kronor, and of chalk to a value of 380 000 kronor.

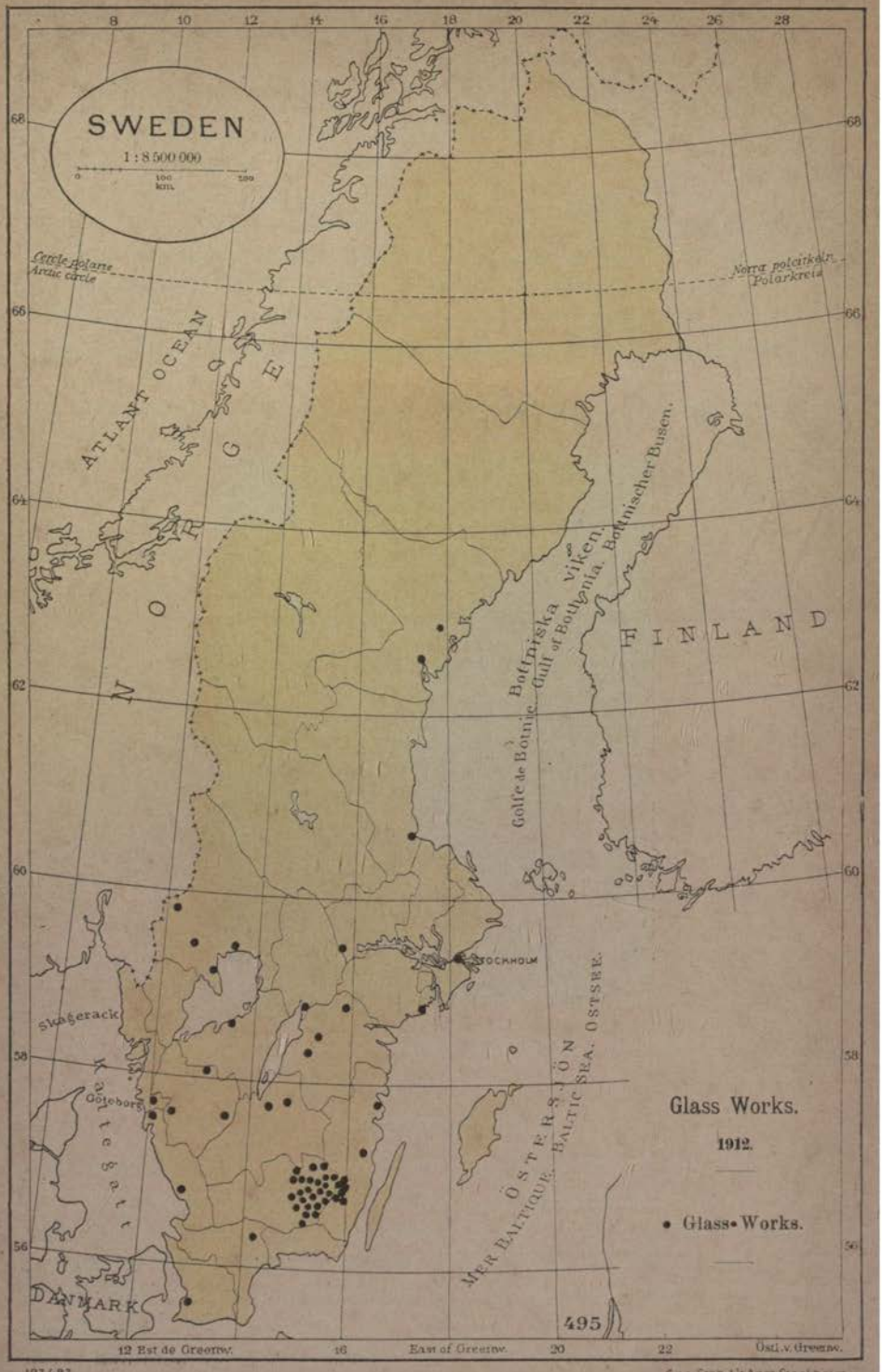
Kieselguhr or infusorial silica, consisting of silicified diatom skeletons, is found in considerable layers in Sweden, both at Osby, in Skåne, and in Lappland. Its chief use is as an isolating medium for steam boliers, bakers ovens, etc., and, formerly, for dynamite. In 1912 there were 2 factories for the preparation of this article, with an output valued at about 7 300 kronor.



Specimens of Heavy Crystal Glass-Ware from Reijmyre.

Glass Manufacture.

The origin of the Swedish glass industry is to be traced to a work which was started between 1640 and 1650. This factory existed till 1815, making both common and finer glassware, but owing to changing vicissitudes it never attained important dimensions. In the middle of the 18th century the industry began to develop through the starting of new works. The older factories still in existence are *Limmared* in Västergötland founded 1740, *Kosta* in Småland 1741, *Sandö* in Ångermanland 1745.

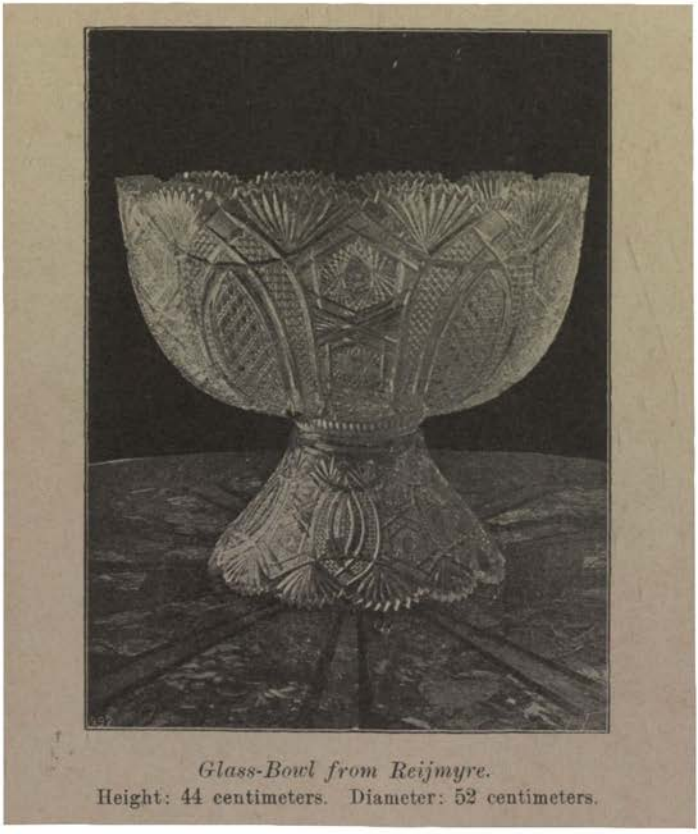


123484 Gen. Stab. Lit. Anst. Stockholm

Liljedahl in Värmland 1761, *Reijmyre* in Östergötland 1808: also *Eda, Surte, Glava,* etc.

To-day Sweden possesses an important glass industry, carried on at 60 glass works. Of these 28 are occupied in table-glass manufacture, 10 in making window-glass, and 16 in bottle making. Some of them carry on different branches. The productive value in 1912 at the table-glass works was 5 137 000 kr., at the bottle-making works 4 493 000 kr., and at the window-glass works 2 292 000, making a total of 11 922 000 kr. The number of workmen employed during the same period was 5 182. Reckoning by läns, Kronoberg takes the first place having an output in glassware of 3 172 000 kr. and 1 638 workmen.

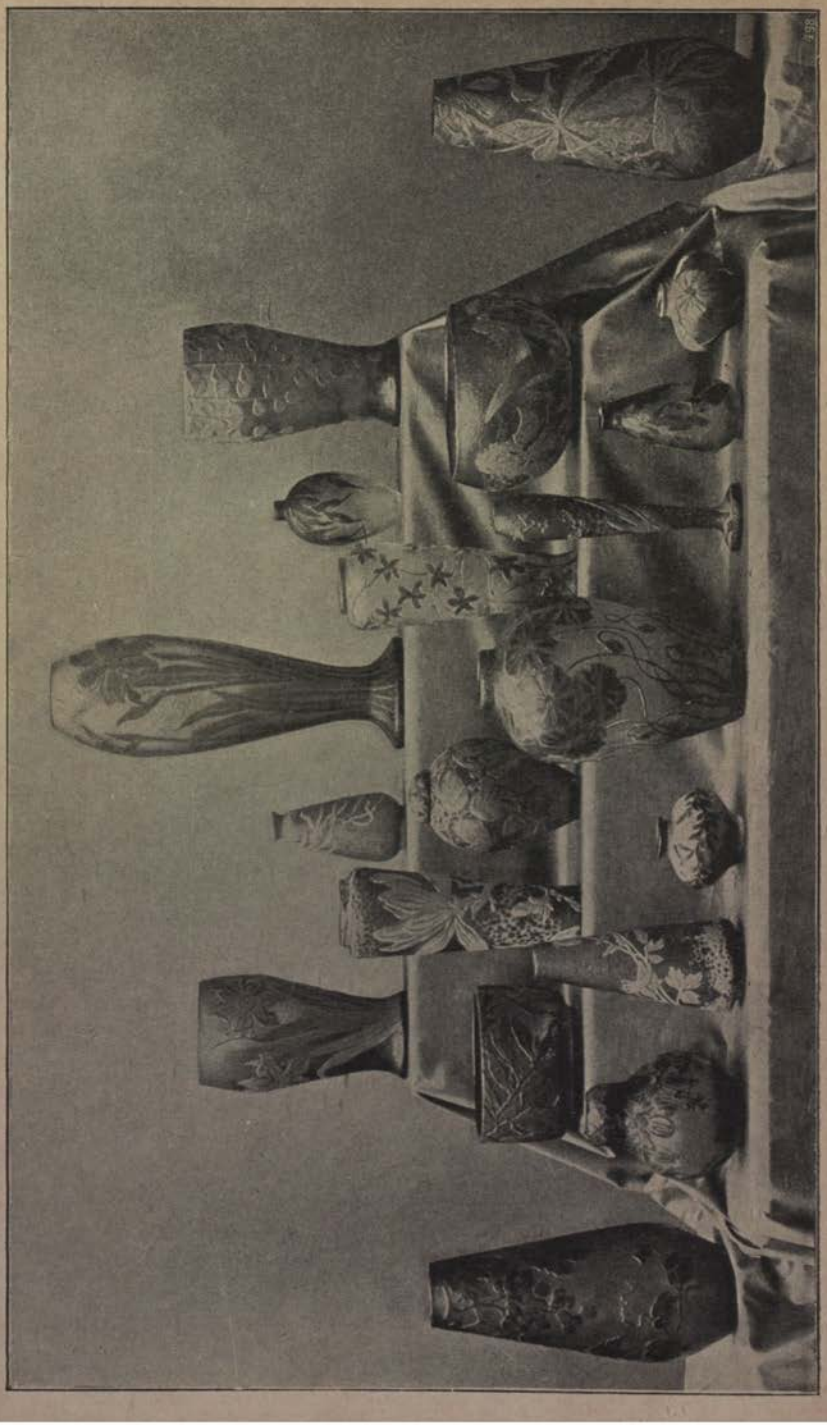
During 1913, the value of the export from the Swedish glass works amounted to 4 019 000 kr. The import in the same year, consisting principally of plate glass and technical glass amounted to 3 145 000 kr.



Glass-Bowl from Reijmyre.
Height: 44 centimeters. Diameter: 52 centimeters.

In 1898, the total product was valued at 6 812 000 kr. The number of workmen being 4 672. The production value has thus risen in 14 years by 5 110 000 kr. per annum. The increase in quantity is, thus, very important, but also in quality there has been considerable improvement. The Swedish glass is now highly valued in the markets of the world and competes successfully with the products of any foreign works.

All the different branches of the glass trade are well represented in Sweden with the exception of plate-glass manufacturing, which is not carried on to the same extent as abroad.



Glass-Ware from Kosta.

TABLE 93. *Glass Works and Cutting Houses.*

Annually	Number of works	Number of workmen	Production Value in thousands of kr.	Imports Thousands of kr.	Exports Thousands of kr.
1861—65	23	1 138	1 581	—	—
1866—70	29	1 241	1 645	—	—
1871—75	31	1 659	2 721	1 635	697
1876—80	34	1 909	2 698	2 949	1 187
1881—85	33	2 171	2 894	3 025	2 116
1886—90	34	2 483	3 122	1 692	1 422
1891—95	45	3 644	4 620	1 523	3 426
1896—00	53	4 952	7 063	1 830	3 896
1901—05	55	5 277	8 848	1 687	3 415
1906—10	59	5 066	10 025	1 959	2 575
1910	62	5 000	10 368	1 960	2 352
1911	59	5 054	10 718	2 013	3 177
1912	60	5 182	11 922	2 208	4 366
1913	.	.	.	3 145	4 019

Artisticly decorated glass and superior kinds of crystal are made principally at the large table-glass works at Kosta, Reijmyre, Eda, Färe, Foglavik and Limmared, while the smaller works manufacture more common goods for regular use. Whether the manufacture be of finer or cheaper goods, the finish and metal are of acknowledged quality.

Some years ago the larger works in the different branches amalgamated. In the window-glass branch may be mentioned *Förenade fönsterglasbrukens aktiebolag*, in the bottle-making branch *Aktiebolaget Surte-Liljedahl* and in the table-glass branch *Aktiebolaget De Svenska Kristallglasbruken;* the last-mentioned company, with a production in 1912 of over 2¼ millions, occupies the third place, with respect to output among the glass works of the world.

The glass industry has thus developed into a very important one for Sweden, so much the more as glass-manufacturing is done largely by hand and does not depend upon machinery, power, raw materials, fuel, etc.; it consequently gives work for more hands than other industries, in which machinery is the principal consideration. It can be stated that on an average the cost of production is 50 % of the finished article, while the cost of the raw material is only about 10 %. These raw materials are imported, as also, to an ever increasing extent, coal is employed for the furnaces, instead of wood fuel, which can be got in the country, but the work, which is the principal thing, is Swedish and it can therefore be contemplated with equanimity that the absence of the natural requirements for this industry is of small importance so long as the employers still keep and develop their skill, so long as technical improvements enable Sweden to hold her place in the competing markets of the world, and, finally, so long as the quality of the finished product maintains the high place which it has acquired in all countries.

Peat Manufacture.

In Sweden there are very approximately 4 million hectares of peat bogs available for the production of peat; their average depth is 2 meters. Every hectare of medium quality peat-moss yields nearly 2 000 tons of prepared peat; the total area, therefore, of the bogs corresponds to 8 thousand

million tons of peat for fuel, which, on the presumption that peat possesses half the heating power of coal, is equivalent to 4 thousand million tons of coal, or enough fuel to last for centuries. With the exception of Russia, there is no country in Europe having such a plentiful supply of peat as Sweden, and scarcely any country has peat of such good quality.

Although peat can be used successfully as fuel for domestic purposes, various industries such as ironworks, cellulose factories, glass and tile works, etc., its use is very insignificant as compared with that of coal and wood, and is not at all proportionate to the natural resources. This is owing to the fact that the preparation of peat depends upon the weather and also to the fact that it has not yet been possible to arrange for the production of peat fuel on a large scale, and therefore there is a state of uncertainty regarding the quantity and quality of the peat and also as to the cost of manufacture. The continuous rise in wages enhances the cost of manufacture, so that, for example, the cost of manufactured peat in the last 12 years has risen from 5—6 to 8—9 kr. per ton, at the same time as the price of coal in port has meanwhile increased from 14 to 20 kr. and upwards per ton: all of which circumstances have caused a state of uncertainty in the peat industry, which can only be removed by an invention by which peat can be manufactured on a large scale, irrespective of weather and seasons. There are, however, good prospects for such an invention (the wet carbonizing process).

Every form of fuel is judged according to its calorific power, which is discovered by experimental burning or by calorimetric analysis. Such methods has been employed by professor *P. Klason* and others, with the result that 1 ton of ordinary coal is found to be equivalent to 1·8 tons of average machine peat, 2 tons of cut peat or 2·5 tons of wood. The cost of freight is, naturally, a matter of greater importance when the fuel is of low value than when it is of high value, this being another disadvantage for peat.

Many attempts have been made to refine peat to a more valuable fuel in the form of peat-coal, powdered peat, and peat briquettes. *Peat-coal*, which seemed at first to promise well, has not become an article of great production, principally owing to the meagre production of the raw material for its manufacture. *Powdered peat* has attracted a little attention but has not as yet been produced on a large scale. Endeavours have been made to manufacture such powder, by air-drying the raw peat, taken out by hand or by excavator, till it contains about 50 % of water, after which the product is dried artificially, until the water is reduced to about 15 %, and can then be either ground to a fine powder which can be used directly as fuel or burnt in a so-called powder-burning apparatus, or it can be compressed, at a temperature of 90°—100° C. under a pressure of as much as 2 000 atmospheres, into peat briquettes in the same manner as in the manufacture of lignite. But up to the present time these attempts have failed through want of raw material in sufficient quantities and low enough in price. Thus the *peat problem* has not yet been solved. It has been suggested that power stations should be located on the bogs, by which means the quality of the peat would not be of such great consideration, and this proposal has been adopted on a small scale, but the state of uncertainty in the preparation of the peat has made itself felt even here.

In addition to peat fuel there is an enormous supply in Sweden of white moss, from which *moss litter* is prepared, both for home consumption and export; during the last few years this material has become of increasing economic importance in farming as a manure absorbant and also as an addition to the manure. The enormous sums which have been lost in ammonia from dung-

yards by its evaporation into the air can now be saved; and the employment of moss litter increases yearly. It is also useful as a preserving element in fruit packing etc., as packing for double floorings, and for other purposes, among others for town cleaning purposes, as a disinfectant for closets, etc.

In 1912, Sweden possessed 32 peat manufactories, apart from those which manufacture for domestic use; these latter do not make statistical returns, although they actually produce greater quantities than the regular manufactories. The 32 above-mentioned manufactories employed 892 hands and produced 41 924 tons of peat, with a value of 407 400 kronor. In the same year there were 125 moss litter manufactories, employing 1 972 hands and producing 192 790 tons, with a value of 2 767 000 kronor. The export of moss litter in the same year was 7 276 tons, and in 1913, including 3 100 tons of powdered peat, the export was 7 135 tons.

In 1902 the Riksdag made a grant of 1·5 million kronor as a so-called *peat loan fund*, which was gradually increased to 3·5 million kronor owing to the many applications for grants. Advances are made out of this fund to approved factories up to $^2/_3$ of the value of the manufactory against good security, which must be approved by the Exchequer. The interest is 4 %, and the amortization of the loan, at the rate of 10 % of the total sum, need not begin until the fourth year after the making of the grant. The State also affords financial assistance in other ways for the solving of the peat problem. In order to assist the peat industry with scientific aid the State has appointed two *peat engineers* with three assistants. In Emmaljunga in Skåne, there is a *peat school*, maintained by the State, in which instruction is given in the preparation of peat for such as wish to fit themselves for the positions of managers or foremen of peat manufactories.

Charcoal.

The Swedish statistics of industry include in the group now under consideration also the manufacture of charcoal; in 1912 there was no less than 23 009 569 hectoliters produced, valued at 12 762 000 kronor. The total number of factories producing it was stated to be 407, employing 6 639 hands. The greatest output was in Kopparberg Län, its value being 2·6 million kronor; then came the Läns of Gävleborg, Örebro and Västernorrland, each with an output valued resp. at 2·3, 2·0 and 1·7 million kronor. — The production of charcoal in the whole kingdom is greater than what is represented by the above figures, owing to the requirements of the ironworks being supplied from sources from which no returns are obtainable. Thus during 1912 the ironworks alone consumed the following:

		Charcoal from forest wood	Charcoal from saw-mill laths
Stack (Heap) charred	hl	30 456 684	9 458 828
Kiln charred	»	2 914 311	389 753
Value	Kr.	22 156 390	6 296 232

The ironworks thus consumed 43 219 576 hl valued at 28 452 622 kr., about double the quantity stated above. The average price for charcoal for the iron industry was 66 öre per hl against the above stated 55 öre per hl.

Even the last-mentioned figures are too low, since charcoal is used in other industries to no inconsiderable extent.

In the year 1913, there were imported 1 198 824 hl and exported 64 815 hl of charcoal.

Gas and Acetylene.

Gas was first used as an illuminant in Gothenburg in 1846, in Norrköping in 1852, and in Stockholm in 1853. There were 30 gasworks in Sweden in 1912, employing 1 586 hands and manufacturing 81 646 000 cubic meters of gas (not less than 51 % of which was produced at the Stockholm gasworks), and 11 822 tons of coal-tar. — The consumption of gas in Stockholm for the five-year periods during 1856—1910 has averaged 13·1, 19·7, 20·1, 23·9, 30·4, 35·2, 44·9, 56·1, 76, 92, and 107 cubic meters per inhabitant. In 1911 it was as much as 110; in 1912 and 1913 the figures rose to 117 and 124 respectively.

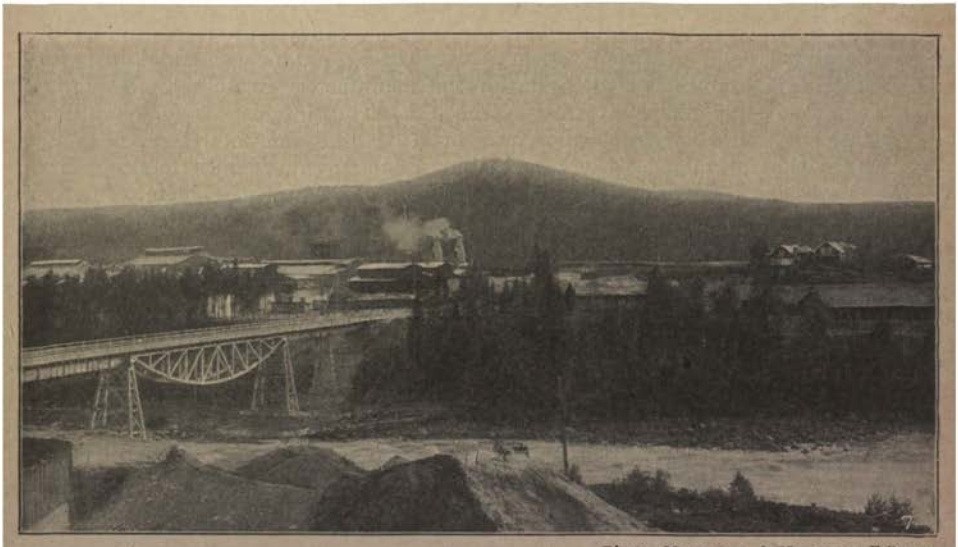


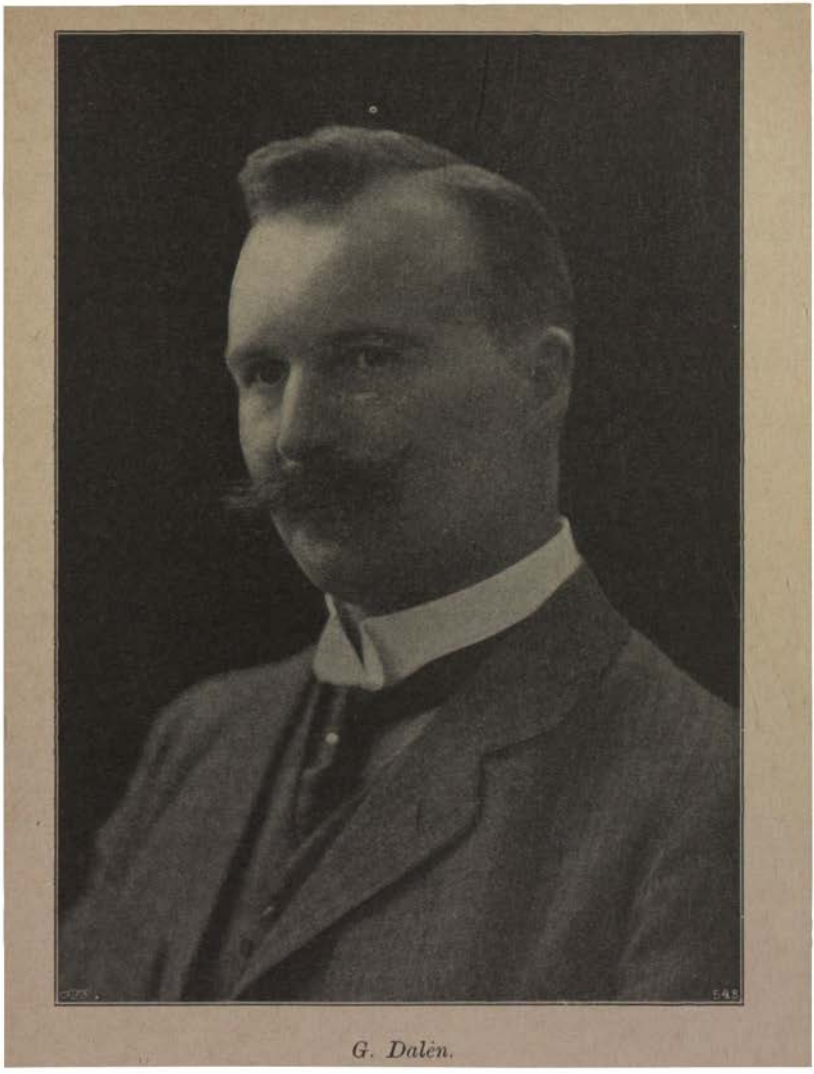
Photo. MAGNUSON & NORBERG, Fränsta.

The Carbide Factory at Ljungafors.

Gasworks have, as a rule, been established by private companies, but the towns have reserved to themselves the right of taking them over after a certain number of years. In the larger towns the gasworks form a very appreciable source of income (that of Stockholm yielded a profit of 1 310 000 kronor in 1913, after allowing for interest and depreciation). Besides being used as an illuminant and a heating agent in domestic cooking, gas is employed as a *driving power* in gas motors. These motors are exceedingly convenient and easily managed, especially when a power not exceeding ten horse-power is required.

As already mentioned above, gas is now widely used as **fuel** in households (there are about 112 000 gas cooking-stoves in use in Stockholm alone); occasionally also in those industrial establishments where an even and easily regulated heat is required, what is called generator-gas is made use of, the fuel — which, for such use, can be of inferior quality — being transformed into gas, before being employed as a heating agent. *Water-gas*, so much used abroad,

especially in America, has not yet been at all generally introduced into Sweden, even though *C. A. Dellwik*, a Swede, has discovered an economical method of producing it.



G. Dalén.

The coal-tar produced at the large gas-works is used to make asphalte, carbolic acid, creosote, and other oils, which are used for impregnating wood and paste-board. For the figures dealing with the import and export of coal-tar, see Table 39, page 218, and for the *manufacture of coke* see page 272. — The sulphur left behind in the oxide after the purification of the gas is recovered by a roasting process, similarly that employed for the production of sulphur acids from pyrites (in the manufacture of sulphite cellulose). At the ten largest gas-works the ammonia is recovered principally in the form of ammonium sulphate; and also the cyan-compounds are recovered at some of the larger gasworks.

A new form of illuminant has been in use since about 1895: **Acetylene gas.** That gas is now generated by a very simple process, viz. the action

of water on *calcium carbide*, that commodity being itself obtained by the reduction of lime by means of coal in an electric furnace. A kilogram of calcium carbide, the manufacture of which at present may be said to cost scarcely 20 öre, produces about 0·3 cubic meters of acetylene gas. The use of the new illuminating agent spread very rapidly, owing to its unrivalled luminosity and the facility with which it can be produced, but the results have not answered expectations. The requisite electric power for the manufacture of calcium carbide is ready to hand at a very cheap rate in the shape of the numerous Swedish waterfalls, and there are excellent prospects of production on a large scale in Sweden; unfortunately, in this case as in many others, enterprise has been checked hitherto by the incompleteness and uncertainty of the law as regards the ownership of the waterfalls. — In 1897, a calcium carbide manufactory was established at the *Trollhättan* falls by G. de Laval, and subsequently manufactories were established at *Månsbo* and *Alby*.

In 1912, the three manufactories of Månsbo, Alby, and Ljungafors, employing 260 hands, produced about 11 120 tons of calcium carbide, valued at 1 724 000 kronor, and of this amount 1 255 tons were exported. Calcium carbide is now directly used chiefly for motor car and bicycle lamps. Recently, too, a considerable amount has been used for the so-called AGA (automatic) lighthouse lanterns, which were invented by *G. Dalén*, a Swede, who was awarded the Nobel prize. At a pressure of 10 atmospheres and a temperature of + 15° C. 100 volumes of acetylene dissolve in one volume of acetone, giving the so-called "*dissousgas*", invented by the Frenchmen, *Claude* and *Hess*, in 1896. When dissolved in acetone, acetylene, which is normally explosive at a pressure of 2 atmospheres, remains inexplosive up to a pressure of 20 atmospheres. And, further, by placing the acetone, before the acetylene is dissolved in it, in steel reservoirs containing a quantity of some very porous substance, all danger of explosion is avoided. The gas is then delivered under reduced pressure. Dalén has, in a brilliant manner, employed this arrangement in the construction of his self-lighting and self-extinguishing lanterns for lighthouses, which are now known and employed over the whole world. Recently they have been adopted for the lighting of the Panama Canal.

Calcium carbide is now most important as constituting the raw material for the preparation of the new fertilizer known as *calcium cyanamide*, which is produced by bringing calcium carbide to red-heat in nitrogen.

At Alby 6 000 tons of this preparation were produced in 1912 for export, and it has now begun to be manufactured at Månsbo. A new manufactory has also been established at Ljungafors, near Johannisberg station. It belongs to the Stockholm Superphosphate Manufacturing Co. and is run by a water-power of 18 000 h. p. It seems probable that this industry may be of importance for the utilization of a part of the country's unused water-power; besides which, this nitrogenous fertilizer will undoubtedly be of importance for agriculture.

See, further, under Chemical Industry (introduction) and Electro-chemical Industry, where these manufactories are dealt with statistically.

9. CHEMICAL INDUSTRIES.

From a technical point of view, this industry has attained a high degree of development in Sweden, but, in spite of an increase in production of about 182 % since 1900, the output is still as a rule comparatively inconsiderable, since in general little can be manufactured beyond the requirements of the country, on account of the difficulties of export. The establishments coming under the heading of chemical industries were classified in the official statistics for 1912 as in the following table, which gives the number of factories and of the workmen employed and the value of the output:

	Factories	Workmen	Value of production
Inorganic acids, bases, and salts	47	375	6 915 000 kronor
Fertilizers	52	985	12 604 000 »
Explosives	21	1 148	7 891 000 »
Dyes and miscellaneous preparations	186	1 361	15 765 000 »
Total	**306**	**3 869**	**43 175 000** kronor

Under this heading the match-making industry, which has been dealt with above might also have been included. If this branch had been included, the number of factories would have been raised to 324, the number of workmen to 10 461, and the value of the production to 59 748 000 kronor.

There seems to be every chance of Sweden making considerable advance in the future with regard to the chemical industry. In certain branches development has, indeed, been checked by the circumstance that in Sweden hitherto the interest in *organic* chemistry has not been so strong as in the case of inorganic chemistry, which fact is the result of the country's rich supply of minerals, even of those which are comparatively rare. This does not, however, imply that organic chemistry has been neglected. In this respect also Sweden is one of the foremost countries with regard to chemical investigations and experiments. One of the most important branches of organic chemistry in other countries — aromatic chemistry — has naturally had no considerable development on account of the shortage of coal and capital. Defective legislation with regard to the utilization of the great supply of water power has also had a paralysing effect on electrochemical and electro-thermic industry.

Sulphuric Acid.

In Sweden sulphuric acid is manufactured for the most part in conjunction with the production of superphosphate, for which it is directly required. It is further used on a large scale for the manufacture of hydrochlo-

ric acid, nitric acid, in factories for making stearine, explosives, German yeast, and many other articles. In 1912 there were 8 sulphuric acid factories with 121 workmen and an output of 126 749 000 kilograms (50° B.), of the value of 2 921 000 kronor. During the seventies of last century, the production amounted to only 4 000 000 kilograms a year, during the eighties to 11 200 000 kilograms, and in the first half of the nineties to 28 000 000 kilograms a year. For some years there has also been a manufacture in Sweden of fuming sulphuric acid, so-called "*Oleum*", mostly for the preparation of explosives. The import in 1913 amounted to 1 113 000 kilograms of the value of 61 200 kronor; the export amounted to about 40 000 kronor. Iron pyrites, the raw material for sulphuric acid, which is also used in the manufacture of sulphite pulp, was imported in 1913 to the extent of 141 005 000 kilograms (mostly with about 3 % of copper), of the value of 3 525 000 kronor. The import of sulphur, which is mostly used for the production of sulphite pulp, was in the same year no less than 39 715 000 kilograms, of the value of 3 574 000 kronor.

The manufacture of sulphuric acid is given in the following table:

Annually	Tons	Annually	Tons
1866—1870	751	1901—1905	60 740
1871—1875	2 994	1906—1910	101 564
1876—1880	5 044		
1881—1885	9 357	1910	117 991
1886—1890	13 127	1911	126 810
1891—1895	30 025	1912	126 749
1896—1900	37 289		

Chlorates.

Chlorate is an indispensable ingredient in the manufacture of matches, fireworks, and certain kinds of gunpowder; since the electrolytic method of manufacturing has become known, the electric energy required for its manufacture has been generated with the aid of water power. The first chlorate factory, which was at the same time the first electro-chemical factory in Sweden, was established in 1893, at the instigation of Director *Oscar Carlson*, by the Stockholms Superfosfatfabriks Aktiebolag at *Månsbo*, in Avesta, at one of the waterfalls of the river Dalälven. In 1898 was erected at *Alby*, in Västernorrland Län, another chlorate factory, deriving power from the waters of the Ljungan, which flows past the factory. By means of the electric current, chlorine is liberated from an alkaline chloride and, by acting on the alkali which is at the same time liberated, forms chlorate.

In 1912 the two factories above mentioned employed together 185 workmen and about 5 700 horse-power.

	Kg	Kr.
Production, mostly potassium chlorate	3 418 000	1 859 000
Import	227 800	132 000
Export	1 653 000	794 000

In 1913 the imports and exports were 253 400 and 1 423 000 kg respectively. In order to produce this quantity, 2 222 000 kg of potassium chloride, with a value of 440 000 kronor, were imported in the same year (1912).

The chlorate factory at Alby is owned by the Alby Nya Kloratfabriks Aktiebolag, all the shares of which are in the hands of the Jönköpings och Vulcans Tändsticksfabriks Aktiebolag.

Since 1895 a factory has existed at *Bengtfors* for the electro-chemical production of *caustic soda* and *potash* and *chloride of lime* (bleaching powder). The value of the output amounts to about 235 000 kronor per year.

Artificial Fertilizers.

The manufacture of fertilizers containing phosphoric acid, in the form known as **superphosphate,** commenced about the year 1871, since when this industry has undergone considerable development. The pioneers in Sweden for this industry, which has now attained such considerable dimensions, are Director *O. Carlson*, of Stockholm, and Consul *N. Persson*, of Hälsingborg. Although both conglomerates and apatite containing phosphorus occur in Sweden in such a pure state as to supply a suitable raw material for the manufacture of superphosphate, it has nevertheless proved necessary to cover the demand of the factories for raw phosphate to a great extent by importation, principally from America. The phosphates of lime obtainable from Florida, Carolina, and other recently discovered sources of supply are to be had at prices which exclude all possibility of competition. Sweden possesses at the present time (1912) 6 superphosphate factories with 579 workmen and an output of 168 478 tons, valued at 9 253 000 kronor.

The production of superphosphate is shown by the following figures:

Annually	Tons	Annually	Tons
1871—1875	2 993	1901—1905	98 154
1876—1880	8 698	1906—1910	146 220
1881—1885	28 943		
1886—1890	42 965	1910	167 103
1891—1895	54 057	1911	184 883
1896—1900	56 986	1912	168 478

Sweden possesses excellent possibilities for an extensive manufacture of **Thomas phosphate** (basic Bessemer slag), as the iron ores containing apatite, which occur in many places, particularly in Grängesberg and Norrbotten, on being worked by the basic Bessemer process, yield phosphate as a by-product in and with the slag. This process was applied for the first time in 1892, at Domnarvet, for the manufacture of iron from Grängesberg ores. In 1912 there existed one factory for the manufacture of Thomas phosphate, and the entire output amounted to 14 978 tons.

The manufacture of **bone meal** was carried on in 1912 in 15 larger and smaller factories and bone-grinding mills in several provinces of Sweden. In addition to bone-meal, some of them also produce bone-fat, bone-glue, and bone-charcoal.

In years when the herring fishery is good, a part of the catch is devoted to the preparation of **herring-oil** (see Fatty Oils) and **herring-guano;** these products are obtained by boiling the herrings until the oil separates, after which the remainder is pressed and dried; the substance then obtained is called fish-guano. This industry is confined to Göteborg och Bohus Län, where in 1897 no less than 17 factories were engaged in it, with a production estimated at 1 064 000 kronor, of which 778 000 kronor was for guano. In recent years, however, this industry has practically come to a standstill, since the herring fishery has declined, and a better sale for the fish has been obtained, as a result of improved means of communication.

Various towns, such as Stockholm, Gothenburg, and Karlstad, have established **pudrette factories,** for the purpose of utilizing refuse. The total output of these factories, however, did not exceed about 199 000 kronor in value in 1912.

Ammonium sulphate is included in the "inorganic acids, bases and salts" (see above). Concerning **Calcium Cyanamide,** see Gas and Acetylene and Electrochemical Industry.

Explosives.

The manufacture of ordinary black gunpowder was known in Sweden as early as the beginning of the fifteenth century. As is well known, gunpowder is made from charcoal, sulphur, and potassium nitrate. Sweden possesses natural supplies of charcoal and sulphur (in the form of metallic sulphides), whereas formerly, before potassium nitrate, the so-called conversion saltpetre, was obtained by the addition of potassium chloride to sodium nitrate, this ingredient had to be produced artificially by soaking it out of the earth under stables and cattle sheds and mixing it with potash. Saltpetre was also produced by means of special so-called saltpetre boxes, in which a mixture of soil, wood ashes, and urine was combined in such a way as to yield a tolerably large quantity.

In previous centuries, since the time of Gustavus Vasa (1523—60), when the manufacture of gunpowder was taken over by the State, the government levied saltpetre as a kind of crown tax on almost all land, at the beginning in the form of a right to dispose of the saltpetre soil from under the cattle sheds, which the State saltpetre makers were entitled to boil out; subsequently the landowners themselves were obliged to supply the saltpetre or pay an equivalent sum of money. From 1815 to 1893, the country was divided into saltpetre-making districts for the management of matters connected with saltpetre, each district being under a director; at first there were 13 districts, but the number gradually diminished, so that in 1883 only one district, that of Västerbotten, remained. The manufacture of saltpetre was under the superintendence from 1811 to 1866 of the committee for matters connected with saltpetre, and subsequently of the artillery department of Army Board. In 1893 the State relinquished all connection with saltpetre, which is not now produced in the country, the small amount required being imported from abroad, principally from Germany.

The Vinterviken Explosives Factory, near Stockholm.

In the meantime, the manufacture of explosives has entered upon a new phase; the year 1864 marks a new epoch in the technics of explosives, for it was in that year that *Alfred Nobel* established the *Vinterviken* dynamite factory, the oldest of its kind in the world. The effective ingredient of **dynamite** is nitro-glycerin, and this substance, which is obtained by treating glycerin with a mixture of strong nitric and sulphuric acids, is much cheaper and more powerful than ordinary gunpowder. By mixing nitro-glycerin with infusorial earth, a solid explosive is obtained, which is less dangerous to handle, and this it is which is called dynamite. It is also possible to combine nitro-glycerin with other explosive substances and thus to obtain explosives with slightly varying qualities, suitable for various purposes. Such combinations are called, for instance, **sebastine** and **ammoniac-gunpowder.** Another very powerful explosive is **gun-cotton** or nitro-cellulose, which is obtained by immersing cotton in a mixture of strong nitric and sulphuric acids. It is also possible to combine nitro-cellulose and nitro-glycerin; the former then swells, or becomes gelatinized, in the nitro-glycerin. A gelatinized composition of this nature is called **blasting gelantin;** if the gelatinizing process is carried out in a suitable manner, the composition, after being dried, can be compressed into a horny, elastic substance, which is less dangerous than, but otherwise quite as effective as, gun-cotton.

Gelatinized and compressed gun-cotton is employed in the production of **smokeless,** or, more properly speaking, almost smokeless, kinds of powder. The fact of the matter is that the products of combustion of nitro-glycerin and gun-cotton consist solely of colourless gases, which fact is of immense importance, particularly in warfare. Smokeless powder was introduced into the Swedish army in 1890. The first variety, known as apyrite, was manufactured by the Swede *Skoglund*, but subsequently the so-called Troisdorf powder, called after the German factory at Troisdorf, was adopted for the army and is manufactured on a large scale at the State powder factory of *Åker*. This powder consists solely of gun-cotton, which has been gelatinized with a mixture of alcohol and ether; it occurs in the form of small glittering scales. For cannon and torpedoes, where a more powerful effect is required, a gelatinized mixture of nitro-cellulose and nitro-glycerin is used, called after its inventor **Nobel powder** or ballistite.

It is possible to say without exaggeration that Sweden has contributed in a very extraordinary degree to the development of the technics of explosives, and it has even been termed "the classic land of the modern technics of explosives". Besides Alfred Nobel's inventions of dynamite and Nobel powder, both of which have been epoch-making, the former as a blasting agent, the latter as a powder for war purposes, there are several other explosives, both powerful and almost free from danger in use, which trace their origin from Sweden. It will be sufficient to mention **bellite** (with its improvement bellona), invented by *C. Lamm*, principally consisting of

TABLE 94. *Gunpowder and Explosives Industry.*

Annually	Factories	Workmen	Value of production, kr.
1866—70	1	40	129 000
1871—75	2	124	498 000
1876—80	5	127	599 000
1881—85	6	116	613 000
1886—90	5	141	648 000
1891—95	10	225	910 000
1896—00	12	326	1 836 000
1901—05	11	487	3 283 000
1906—10	11	532	3 906 000
1910	12	514	3 106 000
1911	12	554	4 138 000
1912	13	558	4 928 000

dinitro-benzol; this substance, even when in contact with red-hot metals, is as harmless as wax, while at the same time it is unaffected by water; but with a sufficiently strong initial lighting it has considerable explosive power.

Among explosives are also to be reckoned *match-cord, percussion caps* and *cartridges,* and also *fireworks,* which last are chiefly manufactured for use in the army.

All kinds of explosives, whether for public or private requirements, are for the most part manufactured in the country, and the supply practically corresponds to the demand. The value of imports and exports respectively in 1913 were 699 000 and 570 000 kronor.

The Table 94 affords an idea of the development of the gunpowder and explosives industry in Sweden since 1866.

In 1912 there was, in addition, 1 *match-cord and fuse factory,* employing 18 workmen; the value of the total output was estimated at 96 000 kronor. *Ammunition and cartridge factories* also existed to the number of 8, employing, 590 workmen and producing goods to a value of 2 964 000 kronor.

As already mentioned, the Swedish State possesses the powder factory of Åker, Södermanland Län, and, in addition, two ammunition factories, Marieberg, near Stockholm, and Karlsborg in Skaraborg Län.

Dyes and Paints.

No coal-tar dyes are made in Sweden, but the coal-tar and other dyes imported are used for making drop-colours, colours soluble in spirit or water, and colour compositions, which can be applied directly to the dyeing of both cotton and wool. Of the colouring matters obtained in the country may be mentioned lampblack, reddle, chalk, umber or ochre of different shades, etc.

Lampblack is prepared by an incomplete combustion of resin, wood, and refuse from the manufacture of resin, tar, and pitch, the soot which is thereby formed being collected; it can also be obtained by grinding charcoal to a fine powder.

Reddle, consisting of iron oxide, is obtained principally by bringing to a red-heat the slime, consisting of basic iron sulphate, which occurs as a decomposition product in a number of mines, e. g., the Falun mine; it was also obtained formerly as a by-product in the preparation of alum from alum-schist. After being mixed with a weak solution of glue and green vitriol, it is very generally employed for painting buildings, and it is considered to be particularly durable and instrumental in preserving wood. Reddle from the Falun copper works has long enjoyed a high reputation.

Fire-proof paint is prepared in such a way as to deposit on the object coated with it a layer of silica, which is neither ignitable nor fusible, and therefore protects the wood beneath it from the danger of fire. This kind of paint can be prepared either with the help of water-glass or by stirring kieselguhr, or finely ground asbestos, in ordinary water-colours.

The greatest output in the colour industry in Sweden is of *colours ground in oil* and *printers' ink.*

The total number of factories coming under this heading amounted in 1912 to 37 with 106 workmen. The value of the production was estimated at 2 284 000 kronor.

With regard to *coal-tar dyes,* the value of the imports amounted in 1913 to 2·5 million kronor. The total imports of colours and dyeing materials had in 1913 a value of 7·3 million kronor, while the exports were insignificant, amounting in all to about 692 000 kronor in value.

Other chemico-technical factories.

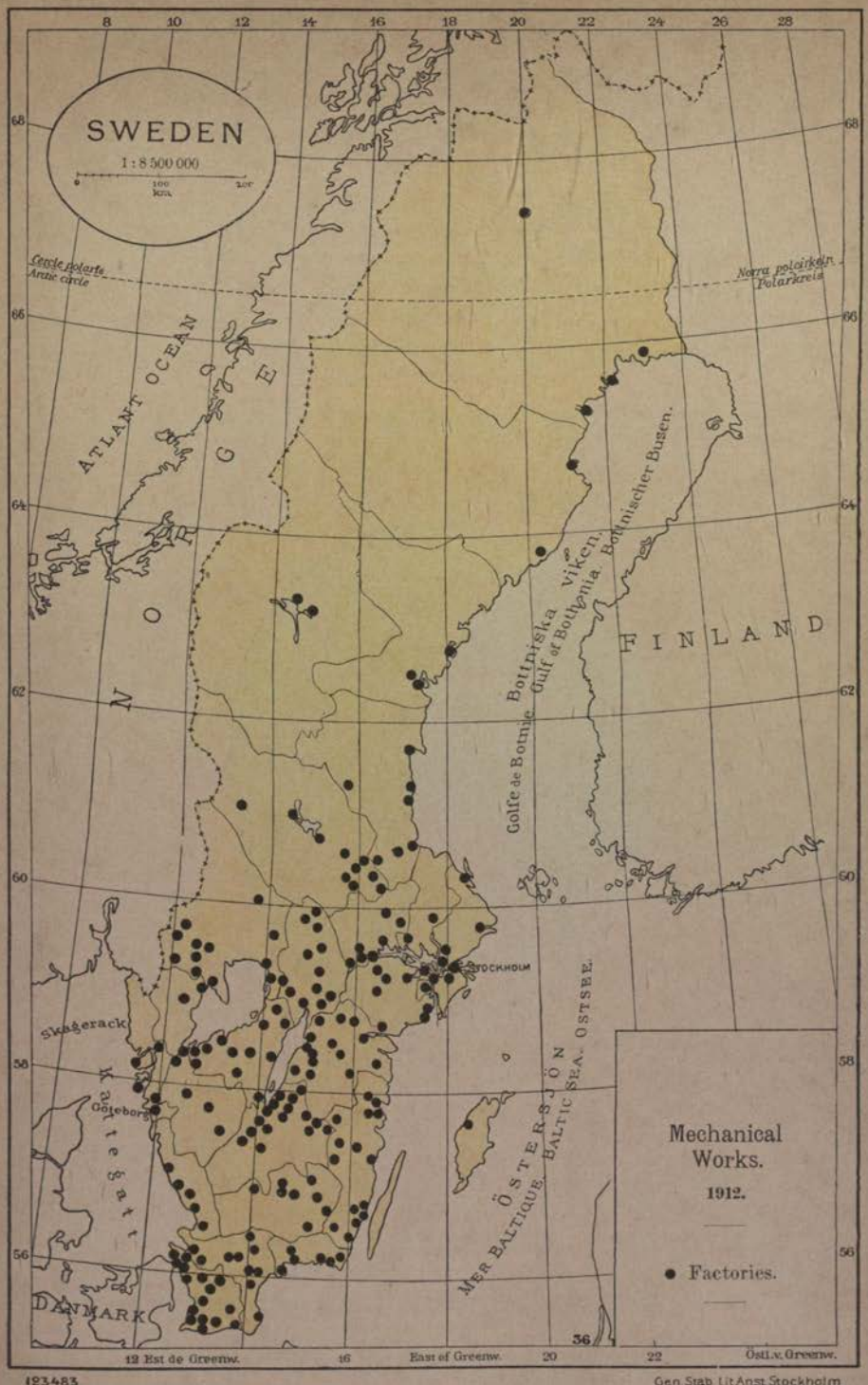
Among the products of these factories may be mentioned *writing ink, carbonic-acid, fruit-tinctures, aseptine,* and all kinds of *antiseptic agents, hair-oils, pomades, lanoline, lac,* etc. Among the older and better known manufactures we may mention *Henrik Gahns Amykos-aseptine,* in which boric acid and peppermint-oil are the most effective ingredients; among newer products may be noted *Stomatol,* containing terpineol, together with *Salubrine* and *Lazarol,* in which acetic ether plays the most important part. The value of the output in 1912 was 11 176 000 kronor.

Another industry in Sweden is the manufacture of fluid **carbonic acid;** it dates from the beginning of the nineties of last century and is now carried on in three factories, two at Lövholmen, near Stockholm, and one at Limhamn, in Skåne. The total output in 1912 amounted to 868 000 kilograms.

10. METAL AND MACHINE INDUSTRY.

This large group may be divided, according to the official statistics available for 1912, in the following manner:

	Factories	Workmen	Value of production, kr.
Iron and Steel Goods	687	24 754	113 071 000
Other metal works	364	6 522	45 721 000
Vessels and boats	75	6 252	15 970 000
Carriages and vehicles	90	2 509	13 826 000
Machines and implements	562	28 108	128 461 000
Instruments	74	1 159	4 200 000
Clocks and watches	7	137	220 000
Total	**1 859**	**69 441**	**321 469 000**



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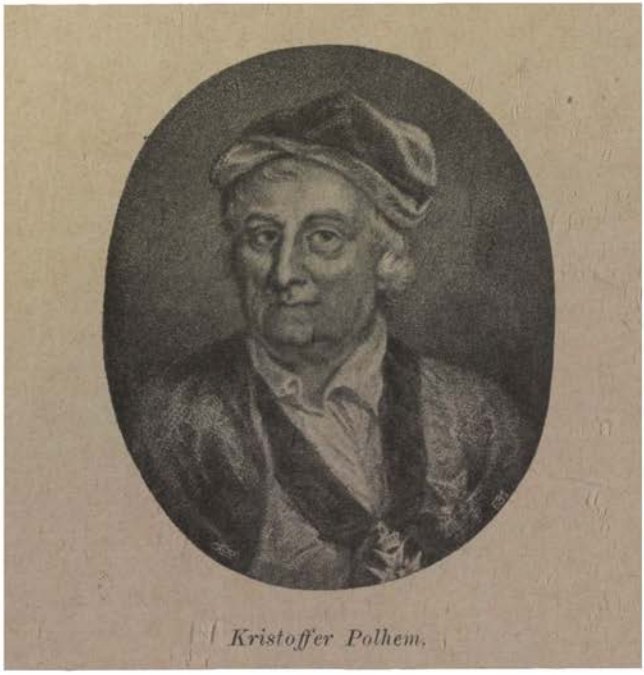
Gen. Stab Lit. Anst. Stockholm

It should be remembered that these figures do not include the production of raw material, iron and steel, or other metals, already dealt with under the heading of Mining.

Even before the great industrial revolution brought about by the invention and perfection of the steam engine, at the end of the 18th century, and its introduction into Sweden, at the beginning of the 19th, several Swedes had made themselves known in the machine industry of that time both by theoretical work and practical applications, of which fact we are reminded by the names of *Polhem, Rinman, Nordewall, Broling,* and others; to this list may appropriately be added the esteemed name of the iron-works owner *P. Lagerhjelm*, through whose invention, in 1826, of a machine for testing iron and steel, the initiative was given for the mechanical tests of materials which have now been generally introduced, and the importance of which, for all kinds of building and consequently also for the machine industry in general, cannot be overrated.



Kristoffer Polhem.

An independent machine industry in the modern sense of the expression naturally did not exist in Sweden, but the industry was coupled with the production of the most important raw material, iron, and its first refining process, and was thus transferred to the iron works. At several of these places important mechanical works were subsequently established; but the present machine industry in Sweden, with its numerous modern technical resources, really dates from the period when the steam engine began to come into general use and the machine tools invented in England for working iron were introduced. Since that time, several Swedes have invented

machines of great value, such as *John Ericsson, Carlsund, Palmcrantz* (machine-guns), *L. M. Ericsson* (telephonic apparatus), *Per Persson* (knitting machines), *A. Lagerman* (complete machines for the match industry), *J. G. V. Zander* (gymnastic treatment apparatus), *Jonas Wenström* (electrical apparatus), *de Laval*, the brothers *Ljungström*, *Wingquist*, and others.

Tthe centres of the machine industry are the *mechanical works* and *the foundries*. These are scattered all over the country in great numbers, particularly in the coast towns and at inland places from which communications are facilitated by means of lakes, canals, and railways. In the choice of a situation for mechanical works, weight has often been attached to the existence of a waterfall in the neighbourhood, the fertility of the surrounding country and the proximity to large factories, such as spinning mills, weaving mills, paper mills, etc. Even until about thirty years ago, new mechanical works were established principally for the purpose of carrying out repairs and supplying rough castings for the requirements of agriculture and of factories. In order to be able to afford the hands regular employment, these *repairing works* were soon obliged to devote themselves to *special manufactures*, which however, as a rule, only consisted of articles such as were used in the country and especially in the vicinity of the workshop. Within the last few decades, however, an essential change has taken place in this respect, and not only have the old mechanical works been reorganized, but many new ones have been established and equipped with the best modern machines and methods, in order to devote themselves exclusively to special manufactures. In this connection may be mentioned a more general use of moulding machines in the foundries, together with grinding and cutting machines, when this can be conveniently effected, in order to avoid the more expensive work on lathes and planing machines. Finally, important improvements have been effected in many establishments by the application of motive power and its distribution hydraulically, pneumatically, or electrically, and by the introduction of electric lighting, etc.

Swedish works have successfully competed at most of the large international and other industrial exhibitions and have carried off well-deserved prizes, and it is no longer unusual that foreign engineers and other professional men visit the larger Swedish establishments for the purpose of study.

According to the official statistics, the value of the goods produced by the iron and steel manufactories, together with foundries and mechanical works, amounted in 1912 to 290 134 000 kronor and have increased since 1900 by 154 %. It must, however, be observed that these sums include also the value of a number of rolling-mill products, such as sheetmetal, wire, tubes, etc. Some details with regard to manufacture, as also in respect of import and export, are given below.

It is worthy of notice that the proportion obtaining between the produc-

tions of the various centres for the machine and metal industry in Sweden has considerable changed in recent times. Gothenburg, for instance, has shown a remarkable stagnation, while Stockholm has made great progress; there has been a great advance also in the case of Norrland and of Malmö with the places in its neighbourhood. In the case of Malmö, this is explained by the great development of industry in general in Skåne, which is endowed by nature with an especially fertile soil, extremely suitable even for the beet sugar industry, and which possesses a considerable supply of coal and various raw materials, such as fire-clay etc. A progressive development of the metal industry is also noticeable at Eskilstuna and the surrounding district, suggesting that industrial products from this town have begun to gain ground on the world's markets.

With regard to the country's machine industry in general, there appear to be grounds for hoping for a still greater development in the near future than that which has taken place in the last few decades. As a matter of fact, the progress at present being made is extraordinary and even exceeds the great development which took place at the beginning of the seventies of last century, in the years immediately following the Franco-Prussian war. At that time also the fires in the furnaces of the machine industry blazed livelier than ever before, but the liveliness then depended, in many respects, principally upon foreign capital, which overflowed when the dams were burst which the war had set up against it. Towards the end of the same decade, a decline set in, so that several newly established undertakings were obliged to stop work or to change hands, while older and larger establishments which had begun to decline were reorganized. The development which is now taking place in the Swedish machine industry may perhaps be explained principally by the favourable economic conditions in the world's markets, but it also appears to be based more than was the case in the seventies of last century upon the natural resources of the country, and consequently the hope appears to be justified that it will continue for a considerable time to come.

Of the more important articles, which are included in the official manufacturing returns under the two headings "Metal Works" and "Vessels, Carriages, Machines and Implements" — which are not always easy to distinguish from each other — the following show the highest **value of production** in 1912:

Articles	Value	Articles	Value
Diverse iron and steel wares	Kr. 40 826 000	Vessels and boats	Kr. 15 970 000
Castings of pig iron	» 27 797 000	Machines for industry and trade[5]	» 14 352 000
Diverse machinery, incl. of instruments[1]	» 25 387 000	Dairy machines	» 13 914 000
Electric machines[2]	» 24 905 000	Machines and implements for agriculture	» 13 094 000
Diverse metal wares[3] . . .	» 23 414 000		
Diverse motors[4]	» 16 972 000		

[1] Also musical instruments, clocks, and watches. — [2] Dynamo machines, accumulators, transformers, telegrafic apparatus, telephones, lifts, electric and incandescent lamps. — [3] Of other metals than iron. — [4] Gas-, petroleum-, warm air- and water turbines, but not steam engines. — [5] Not specified.

Articles		Value	Articles		Value
Cold rolled iron and steel, incl. of drawn iron wire	Kr.	9 663 000	Thin sheet iron	Kr.	4 410 000
Railway and tramway cars	»	8 745 000	Tubes of wrought iron and steel	»	3 922 000
Plate vessels, tinning goods	»	8 004 000	Electric wire, covered	»	3 386 000
Gasification lamps and petroleum stoves	»	7 063 000	Guns, mitrailleuses, rifles, projectiles		2 974 000
Machines for working metals and wood	»	6 169 000	Gold and silver goods	»	2 817 000
Galvanized and etched works	»	5 774 000	Horse shoes, nails, and frost nails	»	2 803 000
Steam boilers, locomotives, portable engines	»	5 761 000	Knives and scissors	»	2 055 000
Cycles	»	5 642 000	Joinery goods for machines and implements	»	1 633 000
Diverse carriages	»	5 081 000	Chains, cables, and wire ropes		1 662 000
Nails	»	5 001 000	Saw-blades and saw-blade materials	»	1 286 000
Cast metal goods[1]	»	4 912 000			

[1] Not iron.

With regard to instruments, watches, and clocks, see Table 95 and also the articles specially mentioned below.

A summary of the **imports** and **exports** of articles under this heading is given in Table 95. This table testifies to excellent progress in the Swedish metal and machine industry, exports from 1912 being preponderant. The greatly increased importation of machinery, together with the simultaneous enormous rise in exportation, is one of the often recurring testimonies of the great industrial development of these years.

The imports and exports of wrought iron and steel goods and of other wrought metals include a multiplicity of articles, only a few of which attain to considerable values. Among the imported goods may be specially

TABLE 95. *Import and Export of Metal Goods, Machines, Instruments, etc.*[1]
Value in thousands of kronor.

Articles		Annually 1871—75	Annually 1876—80	Annually 1881—85	Annually 1886—90	Annually 1891—95	Annually 1896—00	Annually 1901—05	Annually 1906—10	Year 1913
Iron and steel goods	Imp.	6 846	5 070	7 290	8 979	10 556	17 148	17 750	19 110	26 658
	Exp.	1 458	1 285	4 227	4 111	4 735	7 893	11 881	14 569	46 163
Other metal works	Imp.	2 680	2 779	4 961	5 097	7 287	8 720	11 782	13 935	17 208
	Exp.	79	105	109	138	244	1 094	1 416	3 459	8 538
Vessels and boats	Imp.	340	96	348	754	1 330	5 699	6 501	6 721	8 139
	Exp.	—	55	25	762	937	613	543	345	941
Carriages	Imp.	222	88	59	224	124	287	412	1 537	5 082
	Exp.	17	68	238	27	41	18	69	254	1 425
Machines, implements, and tools	Imp.	11 555	7 679	8 903	10 612	11 059	23 321	20 567	27 908	29 768
	Exp.	1 137	1 386	2 483	2 738	4 076	9 155	11 507	26 835	59 970
Instruments	Imp.	571	395	1 037	1 148	1 865	2 525	2 733	3 530	5 182
	Exp.	18	13	23	88	331	1 758	2 823	3 727	622
Clocks, watches and parts	Imp.	1 373	1 780	2 167	2 407	3 116	3 376	3 023	2 435	3 097
	Exp.	10	2	4	4	9	10	14	10	8
Total	**Imp.**	**23 587**	**17 887**	**24 765**	**29 221**	**35 337**	**61 076**	**62 768**	**75 176**	**95 134**
	Exp.	**2 719**	**2 914**	**7 109**	**7 868**	**10 373**	**20 541**	**28 253**	**49 199**	**117 667**

[1] The classification corresponds approximately to that adopted in the introduction above.

mentioned rails with accessories, amounting to a value of 6·64 million kronor in 1912, (6·72 millions in 1913); beams, chammels, and angles, amount-

TABLE 96. *Imports and Exports of Machinery, Tools, and Instruments.*[29]

I. *Machinery and implements not specified in the customs tariff.*	*Imports* kronor Year 1911	*Exports* kronor Year 1911
A. Motors, not electric	534 385	6 678 372
B. Working Machines		
First group[1]	1 706 387	65 230
Second » [2]	2 094 474	753 485
Third » [3]	165 244	2 167 259
Fourth » [4]	547 621	52 614
Fifth » [5]	960 844	110 400
Sixth » [6]	765 614	72 734
Seventh » [7]	126 460	2 003
Eight » [8]	77 671	446 552
Ninth » [9]	765 481	15 362
Tenth » [10]	2 358 947	83 655
Eleventh » [11]	718 639	12 266
Twelfth » [12]	118 521	18 718
Thirteenth » [13]	163 949	51 495
Fourteenth » [14]	25 927	—
Fifteenth » [15]	2 504 486	19 110 580
Sixteenth » [16]	410 274	1 336 974
Seventeenth [17]	1 796	30 420
Eighteenth » [18]	1 170 221	597 324
Nineteenth » [19]	52 413	29 624
Twentieth » [20]	5 522 731	3 346 520
C. Tools	1 017 616	1 286 320
Total I	**21 809 701**	**36 267 907**

II. *Machinery and implements specified in the customs tariff.*	*Imports* kronor Year 1911	*Exports* kronor Year 1911
Squirts[21]	131 535	133 119
Electric incandescent lamps	1 055 851	197 400
Electric machines[22]	1 009 560	3 454 441
Gas- and water meters	339 937	191
Locomotives	156 522	25 000
Shovels, spades, etc.[23]	149 312	151 663
Sewing and knitting machines[24]	2 106 812	125 503
Saws, sawblades[25]	148 050	427 521
Cycles[24]	1 422 007	449 787
Steam engines[26]	450 008	972 924
Total II	**6 969 594**	**5 937 549**

III. *Instruments.*		
Compasses and drawing instruments	103 650	2 450
Weighbridges	7 961	10 073
Electricity meters	766 620	1 365
Photographic cameras[24]	209 910	3 290
Lighthouse apparatus[24]	—	826 490
Surgical[27]	969 806	237 740
Optical	219 266	4 398
Telephones[28]	239 470	5 052 158
Musical	1 140 941	62 129
Total III	**3 657 624**	**6 200 093**

Total export for I, II, III[29] . . . . . **48 405 549** kronor
» import » » . . . . . **32 436 919** »
Surplus of export . . . . . 15 968 630 kronor

[1] Using electricity, exclusive of physical instruments. — [2] For working metals. — [3] For working wood and similar materials. — [4] Wood pulp industry. — [5] Paper industry. — [6] Printing industry. — [7] Book-binding industry. — [8] Match industry. — [9] Leather, rubber, and glue industry and hat-making. — [10] Textile industry. [11] Grain-mill, oil pressing, chocolate, bakery and sweets industries. — [12] Sugar and starch production. — [13] Yeast, spirit, malt beverage and mineral water production. — [14] Margarine manufacture. — [15] Agriculture. Of the imports, the greatest value (1 767 737 kronor) falls under the heading of ploughs, sowing- and reaping machines, reaping machine knives and mowing machines, and of the exports 16 371 959 kr. for mowing machines, horse rakes and hay turners, together with separators (13 446 166 kr.). — [16] Stone, clay, cement, and glass industries. — [17] Peat production. — [18] Lifting and pressing. [19] Foundries. — [20] Other purposes, including the import of cash desk apparatus, typewriters, and calculating machines to the value of 1 224 156 kr. — [21] Fire-engines and garden hose. — [22] Dynamo machines, electromotors, transformers and parts. — [23] Pitch-forks and hay-forks, sieves and riddles. [24] And parts. — [25] And materials for making saw-blades. — [26] And boilers. — [27] Surgical, mathematical, physical, chemical, and navigation instruments. — [28] And telegraphic apparatus, gramophones and phonographs, including 5 035 162 kr. for the export of telephones. — [29] Sections I and II in this table together correspond to the group Machines, Implements and Tools in Table 95 above, and Section III corresponds to the group Instruments in the same table.

ing to 5·61 millions in 1912, (6·15 millions in 1913); and tubes and parts of tubes, amounting to 3·03 millions 1912 (2·96 millions in 1913). Among the exports, important positions are occupied by beams, chammels and angles, and other products of rolled iron and steel, to the value of 28·3 million kronor in 1912, and 22·7 millions in 1913; by dairy machines, amounting to 13·4 millions in 1912, and to 15·2 millions in 1913; by tubes and parts of tubes, of iron and steel, to the value of 5·57 millions in 1912, and 5·26 millions in 1913. The export of cooking, soldering, and warming apparatus consuming petroleum, gasoline, spirit, etc. amounted in value to 6·75 million kronor in 1912 (6·44 millions in 1913); and of telephones to 5·16 millions in 1912 (3·07 millions in 1913). The import and export of machinery, tools, and instruments is given in greater detail, for 1911, in Table 96, which is divided according to the headings of the customs tariff of that time. From 1912 a different classification is employed and therefore only the following summaries for 1912 and 1913 can be given.

In order to illustrate the present position of the machine industry, the following notes are given with regard to some of the largest establishments in the country.

The first place among Swedish works, not only with regard to the annual value of production, but also in respect of the wide dissemination of its products, is at present occupied by the Aktiebolaget **Separator** (share capital 24 million kronor), an account of which has been given, along with other factories for dairy machines, under the heading Dairies and Dairy Industry. The honour of having brought this branch of manufacture to such a high level belongs jointly to the inventor of separator machines, Dr *G. de Laval*, and the manager of the firm *J. Bernström*. The company has also branch establishments at Berlin, in Austria-Hungary, Denmark, Russia (Siberia), while in America the patent rights of the company are held by a joint-stock company, the de Laval Separator, Co., of New York, in which the Aktiebolaget Separator is a large shareholder. The factories of the American company are situated at Poughkeepsie.

Kockums mekaniska verkstads aktiebolag, with foundry, works, and shipyard at Malmö, produces boilers, steam-engines, railway carriages, warships and merchant ships, machines for sugar works, etc., to the value of about 3 500 000 kronor

TABLE 97. *Imports and Exports of Machinery etc.*

	Year 1912		Year 1913	
Machines, apparatus, implements:	Imports, kr	Exports, kr.	Imports, kr.	Exports, kr.
a. Electric	5 456 000	10 040 000	6 477 000	12 256 000
b. Not electric	18 011 000	42 457 000	23 291 000	47 714 000
	23 467 000	**52 497 000**	**29 768 000**	**59 970 000**
Instruments	4 537 000	759 000	5 182 000	622 000
Clocks and watches	2 765 000	9 000	3 097 000	8 000
Total	**30 769 000**	**53 265 000**	**38 047 000**	**60 600 000**
Import	-	30 769 000	—	38 047 000
Surplus of export	—	**22 496 000**	—	**22 553 000**

Launching of the Iron-clad "Thule", at Finnboda.

and employs 1 000 workmen. The foundry and the mechanical works were founded in 1840—41 by *P. H. Kockum,* who enlarged the business with a shipyard in 1871. The business was taken over in 1873 by a joint-stock company.

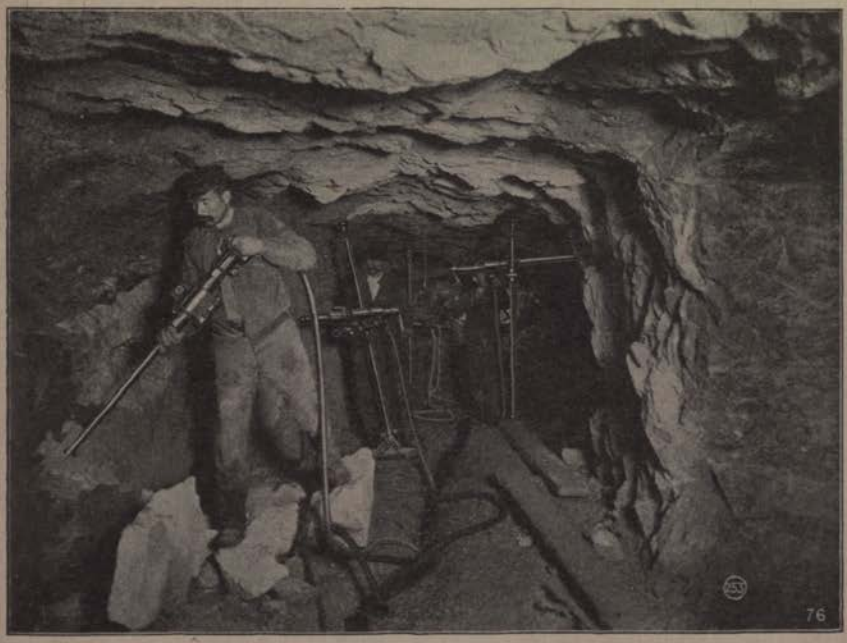
Bergsunds mekaniska verkstads aktiebolag, in addition to a foundry and works at Södermalm in Stockholm, near the Mälaren, also possesses a slip-dock at *Finnboda* near Stockholm on the Baltic side of the town. The Bergsund mechanical works are among the oldest in Sweden. They were founded in 1769 by a Scotchman, Thomas Lewis, were taken over in 1807 by an Englishman, G. D. Wilcke, whose leading engineer was for three years the famous *Samuel Owen.* After the works had changed ownership several times, they were bought in 1858 by A. W. Frestadius and gradually worked up to their present high level, under the direction of the engineer *E. A. Ollman.* The most important manufactures are steamships and railway bridges, all kinds of machinery, castings, and sheet metal, to which have been added in recent years oil motors. Most of the Swedish state railway bridges are supplied by the Bergsund Works. At the Finnboda slip-dock armoured vessels are also built. The value of the manufactures of the Bergsund Works, including the Finnboda slip-dock, amounts to about 3 200 000 kronor and the number of workmen to 1 000.

The **Atlas Works.** In 1873 this magnificent establishment was founded at Stockholm, by the Aktiebolaget Atlas, principally for the purpose of manufacturing railway material, for which there was at that time a large demand, and which also brought about a rapid development of this company. But when, after some years, economic conditions changed for the worse, it had to be reorganized and

was taken over by the Nya Aktiebolaget Atlas. For many years the principal manufactures were locomotives and railway carriages, machine tools, steam boilers, steam engines, hot-water pipes, etc., but the chief products are now air-compressors, pneumatic tools, oil motors, and transport appliances. Among the pneumatic tools may be specially noted the company's famous boring machines for mines, which are used almost exclusively in all mines in Sweden, and in a great number of mines in other countries. Oil motors are also articles of export. In addition, bridges are manufactured. The value of the annual production is about 3 200 000 kronor and the number of the workmen is 600.

The **Bolinder Works**, which are now owned by J. & C. G. Bolinders Mekaniska Verkstads Aktiebolag, were established at Stockholm in 1845, by the brothers *Jean Bolinder* and *C. G. Bolinder*, and, after undergoing steady development, have risen to be one of the most important establishments of their kind in the country. In addition to the works at Stockholm, the company owns the Kallhäll foundry for cooking-ranges and the Bastholmen slip-dock in Bohuslän for fitting motors in boats. In Stockholm it produces steam engines of all sizes, petroleum motors, steam-boilers, saw-mills, the famous wood-planing machines, and cleave-saws made under Westman's patent, stoves, gas-ovens, iron ranges with patented safety apparatus, also of the largest sizes for hotels, boilers and other articles for hot-houses, ornamental castings, etc. The total value of the output amounted in 1913 to about 9 million kronor, and the establishment employed 1 800 workmen.

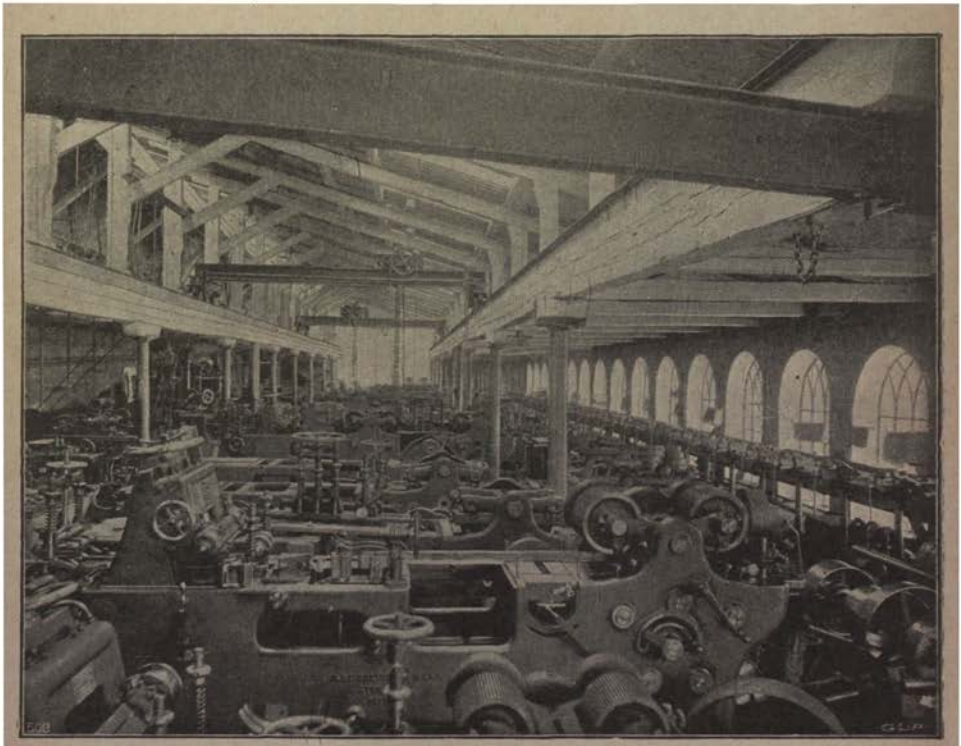
The **Huskvarna** establishment, in the town of the same name, has a long history. It was originally founded in 1689, for the manufacture of rifles for the State, but was taken over in 1757 by private persons, since when it has undergone various changes; it is now owned by the Huskvarna Vapenfabriks Aktiebolag (1867). The principal manufactures are sewing machines, cycles,



Rock Drills (Nya Aktiebolaget Atlas, Stockholm).

cooking-ranges, stoves, radiators, and other cast articles. The value of the output is 7 500 000 kronor and the number of workmen is 1 800.

The **Trollhättan foundry and mechanical works,** situated at the famous Trollhättan Falls, the first real locomotive works in Sweden, were founded in 1847, principally for the manufacture of castings, etc. for mills, saw-works, mining, etc., steel castings and turbines, which last articles have continued to form a speciality of the works. They developed rapidly under the firm *Nydqvist & Holm*, and in the beginning of the seventies, was introduced the manufacture of locomotives, which afterwards became an additional speciality of the establishment. The works can now manufacture one locomotive a week. A great number of the machine-tools used in the establishment are manufactured in the company's own factory. In addition to turbines and locomotives, the works manufacture pumping apparatus for municipal waterworks, iron bridges, air compressors, gas machines, etc. The value of the articles produced is about 3·5 million kronor and the number of workmen, from 1 100 to 1 200.



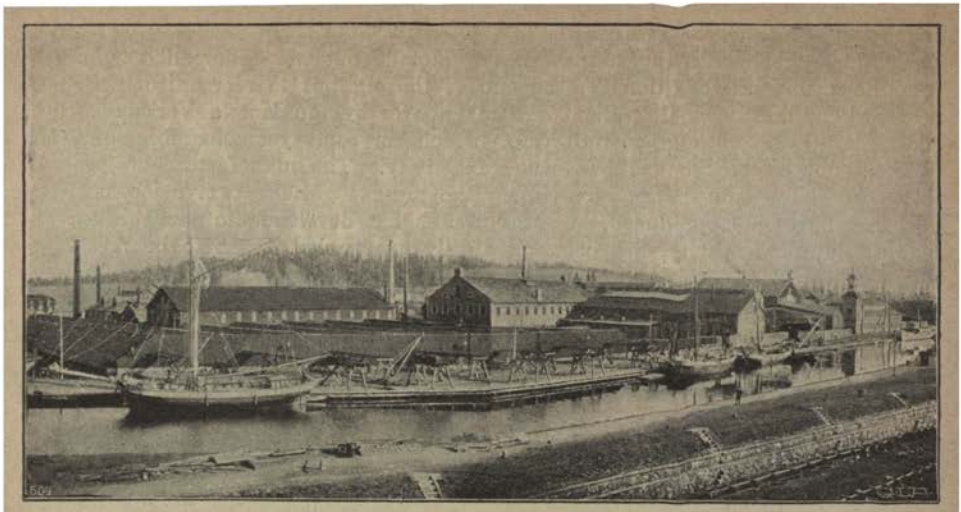
From the Bolinder Mechanical Works, Stockholm.

Motala mechanical works, at one time the largest industrial establishment in Sweden, is situated at the point where the Göta Canal debouches into Lake Vättern. It was founded in 1823, by the Göta Kanalbolag under the superintendence of the Englishman *Daniel Fraser,* developed very rapidly under his skilful management and that of his successor, *O. E. Carlsund*, and was equipped with the best known machine-tools for manufactures in almost all branches of iron working, such as merchant ships and warships, dredging apparatus, locomotives, steam boilers, railway-carriage wheels, sheet-iron, shape-iron rails, wheel and cannon

band etc. In time the owners incorporated other mechanical works, ship-yards, and iron works, with the head works at Motala, but were compelled by unfavourable economic conditions at the end of the eighties to reorganize the business, when the original works were taken over by the Motala Verkstads Nya Aktiebolag (1892). The manufacture, which for some years had been on the decline, now entered on a new phase of activity. The manufacture of locomotives especially gained ground. Under the present owners, twelve locomotives per year have been produced, but this branch has developed to such an extent that the output capacity, has been practically quadrupled, so as to be raised to about one locomotive a week. In addition to this main product, the works also manufacture blooms and ingots, bar-iron, rolled wire, thin sheet metal, large engines for warships and merchant ships, turbines, steamships, railway and other bridges, various iron and metal castings. The number of employees is 1 000. In conjunction with the *Lindholmen* mechanical works (with slip-dock and dry dock) at Gothenburg, orders for armoured vessels are executed. The annual value of production is about 4·25 million kronor.

Locomotive No. 1000 built by Nydqvist & Holm, Trollhättan.

The **Carl Holmberg mechanical works** at Lund have, in the last few decades, been worked up from a modest beginning as a repairs workshop to a factory for industry on a really large scale. The principal products are dairy appliances, distilling apparatus, brick-making machines, steam engines and cast goods, etc. The value of the total production is estimated at 800 000 kronor per year, and the number of workmen is about 250. The same firm also owns the **Armaturfabrik** at Lund, which is the largest of its kind in Sweden for the manufacture



The Motala Mechanical Works.

of cranes, valves, steam-whistles, etc. The value of the output is 700 000 kronor, and 225 workmen are employed.

The **Göteborg mechanical works (Götaverken),** with branches in the town of Gothenburg and in the parish of Lundby, on the island of Hisingen, near Gothenburg, were founded in 1841, by *Alexander Keiller,* a manufacturer of Scotch origin, under whose successful management they rapidly developed and were taken over in 1867 by the Göteborgs mekaniska verkstads aktiebolag, which was incorporated in 1906 in the Göteborgs nya verkstads aktiebolag. The articles manufactured are steamships, including armoured vessels, steam-engines, including engines of considerable size, steam boilers, cranes and elevators, radiators, railway carriages, iron bedsteads, various cast goods, etc., of a total value of about 3 million kronor. The number of workmen is 900.

The **Lindholmen mechanical works,** with ship-yard, slip and dry dock, on the island of Hisingen, near Gothenburg, were established in 1851, by *Th. Tranchell,* but were sold and amalgamated with the Motala works in 1854. The present company, Lindholmens verkstads aktiebolag, was formed in 1894, under the management first of *Carl Norrman* and later of *Sven Almqvist.* The works have gradually grown to be a ship-yard of the first class, manufacturing passenger and cargo steamships of all kinds, warships, steam-engines and steam boilers, and repairing steamships. The value of the output is about 2 million kronor, and 800 workmen are employed.

The **Ball bearing factory** (Sw. abbrev. **S. K. F.**) at Gothenburg was established in 1907, by the Aktiebolaget svenska kullagerfabriken (share capital 12 million kronor). Ball bearings are manufactured, which adjust themselves to the axle automatically, in accordance with *Wingquist's* patent. They are not only sold on the Swedish market, but are also exported on a large scale. The company has branches and warehouses at Berlin, Paris, London, Vienna, St. Petersburg, New York, Melbourne, Buenos Aires, Yokohama, and other places. In the space of a few years, the production has attained enormous proportions, and its value now amounts to more than 6 million kronor. The number of workmen employed is 2 000.

The **Munktell Mechanical works** were founded at Eskilstuna, at the beginning of the thirties of last century, by *Johan Teofron Munktell,* were subsequently

developed and were completed in 1859, by the erection of the *Klosterström* foundry. The manufactures of these works have been steam engines for large industrial works, the first Swedish railway locomotive, the first Swedish machines for manufacturing rifles on a large scale, machines for wood pulp manufacture, etc. At present the principal products are portable engines, steam boilers, threshing mills, straw presses, steam dredging apparatus, digging machines, machine tools and hand tools, raw oil motors, refrigerators, etc. The value of the output is about 4 million kronor. The number of workmen amounts to 850.

The **Karlstad** and **Kristinehamn mechanical works,** which are owned by the Aktiebolaget Karlstads mekaniska verkstad, at Karlstad, manufacture steam launches, lathes for iron rolling works, machinery for the wood pulp and paper industry, portable engines, railway carriages and other railway material, turbines, etc., with a value for both establishments of about 1 500 000 kronor. The number of workmen is 500.

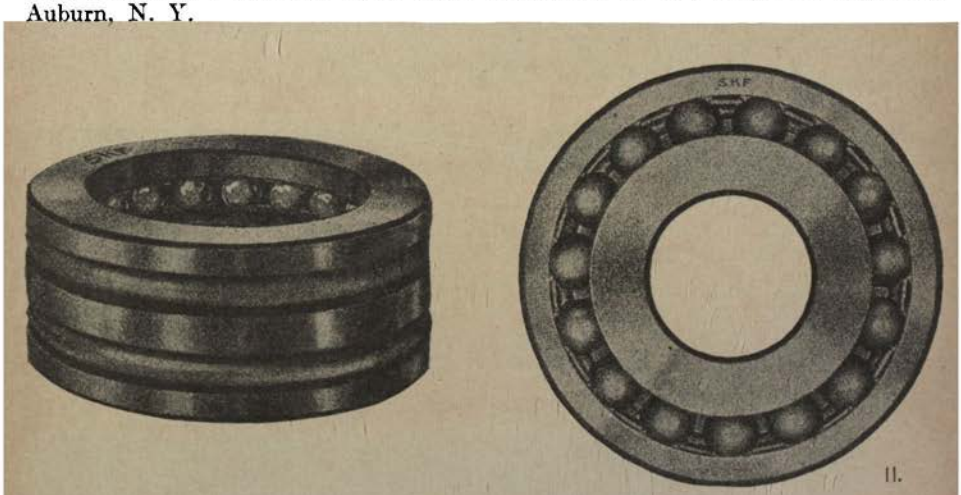
The **Ludvigsberg mechanical works** at Stockholm, which were founded in the middle of the 19th century by *Jacques Lamm* and are now owned by the Ludvigsbergs verkstads aktiebolag, are also very active in the manufacture of radiators and ventilators, refrigerators, pumps, steam fire-engines, etc. The value of the output is about 1 million kronor, and the number of workmen 500.

The **Carriage and machine factory of Falun,** the **Södertälje works,** the **Arlöf mechanical works and wagon factory,** and the **Swedish railway works** at Tannefors manufacture annually large quantities of railway coaches and tramcars. The **Jönköping mechanical works** make a speciality of steam engines, steam turbines, steam boilers, sulphite boilers, paper-making machinery, etc.

The **Aktiebolaget Diesels motorer,** Sickla, near Stockholm. The firm was

From the Motala Mechanical Works.

founded in 1898, and the share capital is now 2 million kronor. The number of employees is about 500. The company manufactures exclusively *Diesel motors* up to the largest sizes, for use as stationery engines and for propelling vessels. The Swedish Diesel motor is protected by international patents and has won a world-wide reputation. Of the output, about 4 million kronor, i. e. approximately two-thirds, is exported. The firm executes large orders, particularly for ship motors, which are built under the patents of the company's head engineer, *K. J. E. Hesselman.* The Swedish *Marine Polar Motor* was the first directly reversible Diesel motor to be constructed and has been fitted in a great number of ships — a greater number, indeed, than any other firm in the world has fitted. Patent-rights for America have been transferred to Mc Imposh & Seymour, Auburn, N. Y.



II.

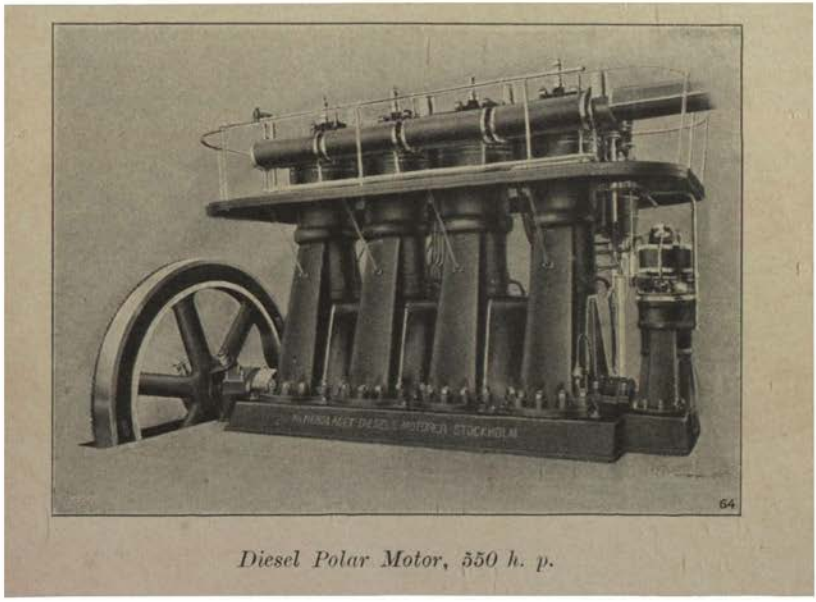
Self-regulating Ball Bearing (Svenska Kullagerfabriken; S. K. F.).

During the last ten years the *motor car industry* has made great progress in Sweden, and good passenger and goods cars are now produced, capable of competing with those of other countries, in the first place by the **Aktiebolaget Scania-Vabis,** of Södertälje, which has factories in that town for pleasure cars and in Malmö for goods cars, boat motors, motor bogies, and railway motor cars. The company is a fusion of the older works of the Maskinfabriksaktiebolaget Scania, of Malmö, and the Vagnfabriksaktiebolaget, of Södertälje. The output amounts in value to about 2·8 million kronor, and the number of employees is 450. The company exports motor cars, even as far as to Australia, the value of the exports being about 400 000 kronor.

Steel pressing is now an important branch of the mechanical industry; from a single sheet of metal whole pressed vessels are manufactured, for use in the household and in dairies, of aluminium, copper, steel, and other metals. By this process, separator balls, mantles for torpedoes, etc. are also produced. The principal factories in this branch are those owned by the **Eskilstuna stålpressnings-aktiebolag** and the **Svenska stålpressningsaktiebolaget Olovström,** which, in addition, manufacture enamelled goods. The value of the annual production of both together is over 3 million kronor. The number of employees is 900.

One of the youngest, but at the same time most successful, of Swedish industrial enterprises is the **Svenska aktiebolaget Gasaccumulator,** of Stockholm, founded in 1904 for the purpose of manufacturing lighting apparatus (so-called

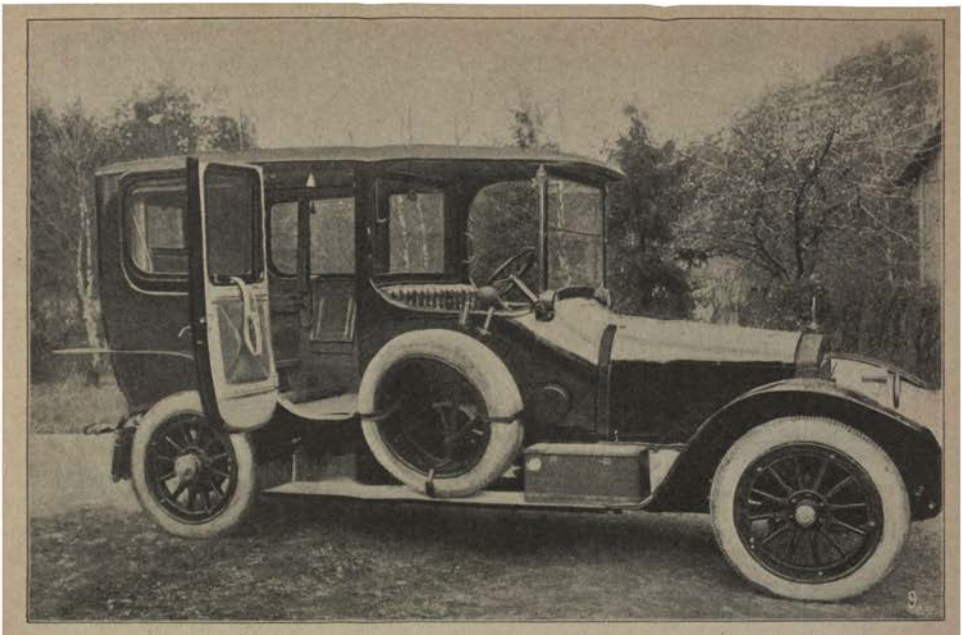
AGA), made in accordance with the inventions of the engineer *Gustaf Dalén,* (Nobel prize, 1912). The company turns out gas accumulators for "dissous" gas stations (see page 430), automatic light signals for lighthouses, buoys and beacons, lighting apparatus for railway carriages, so-called Dalén light, flash-light apparatus for railway signals, lighting apparatus for motor cars and motor boats, military signalling lights, and apparatus for welding and cutting iron and steel, etc. The company has a factory at Skärsätra, on the island of Lidingön; the share capital is 5 million kronor; the value of the output is 3 million kronor, of which 2 million kronor is exported. The number of employees is 300.



Diesel Polar Motor, 550 h. p.

The work of the above-mentioned establishments is devoted almost exclusively to products which do not require any further treatment, but which may be considered as finished articles. The same applies also to the great mass of so-called mechanical works, of which those mentioned are only a few of the most important. In addition to these, there are many other establishments, which, in addition to carrying on the usual business of mechanical works, also produce metals from the ores and perform the first refining processes; these establishments, generally known **as iron works,** as a rule own large forests and tracts of land, etc., while their mechanical works are also often of greater importance than many of the actual works in the country. The following examples may be given of such establishments.

Domnarvet, in the parish of Stora Tuna, on the Bergslagernas railway and on the river Dalälven, twenty kilometers from Falun in Dalarne. These works, which are the largest charcoal iron works in the world, were established in the middle of the seventies of last century; they are owned by the Stora Kopparbergs Bergslags aktiebolag (share capital 12 million kronor) and comprise the following main departments: *a*) smelting department with 5 blast furnaces, 7 Cowper apparatus, 5 roasting furnaces, 3 pounding mills, 3 blast apparatus, etc.;



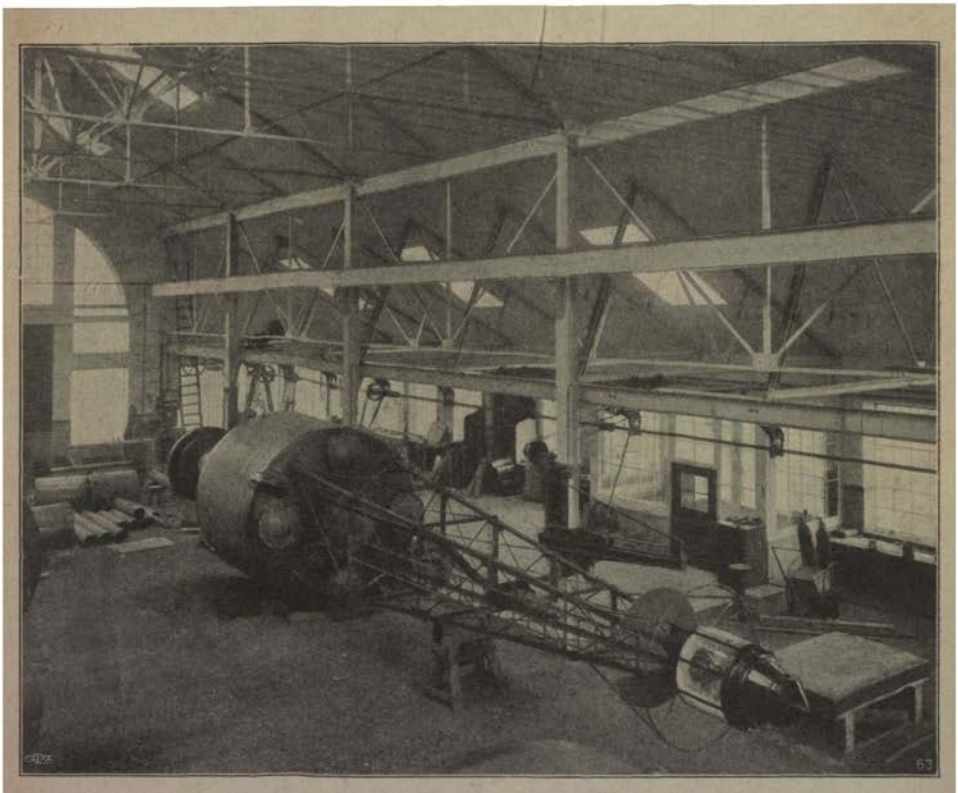
Motor Car from Scania-Vabis.

b) Bessemer works with 4 basic convertors, blasting apparatus, hydraulic power plant, and Thomas phosphate (basic slag) works (15 000 tons); *c*) Martin works with 4 basic Martin furnaces, 2 for 35 tons and 2 for 20 tons, together with steel foundry; *d*) rolling-mill department with continuous wire works, 2 medium works, 2 fine rolling works, 2 universal rolling works, thick and thin sheet works; *e*) rolling works for coarser form iron and rails, driven by 2 steam engines of 6 000 h. p. each. The total annual production is 90 000 tons of pig-iron, of which 30 000 tons is produced by electric smelting, 75 000 tons of rolled iron and steel; nail factory, factory for bolts and nuts, etc.; *f*) workshop department with foundry; *g*) charcoal department with 8 coaling furnaces and a factory for the utilizing of by-products (1 700 tons); annual charcoal production 1·4 million hectoliters. The number of workmen is 2 200

The **Sandviken iron works,** in Gästrikland, were established in 1862, by Consul *G. F. Göransson*, who is famous for his successful work in the direction of rendering the Bessemer process of practical use. The works are now owned by Sandvikens jernverksaktiebolag and have become known all over the world by reason of their excellent products. The works at present consist of 4 blast furnaces, 2 Bessemer furnaces, 7 Martin furnaces, 14 steam hammers, several rolling mills, four of which are for tubes and turn out 300 tons of tubes per week, wire-drawing works, manufacture forge, foundry, mechanical works, etc.: they produce bessemer steel ingot, bar-iron (rolled and forged), tube billets, large shafts, rolled wire, hoop-iron and horse nail rods, sectional iron and steel, saw blades, drawn wire, cold-rolled hoop-steel, and various other manufactures, of a value of about 11 million kronor. The total number of workmen employed is about 2 500.

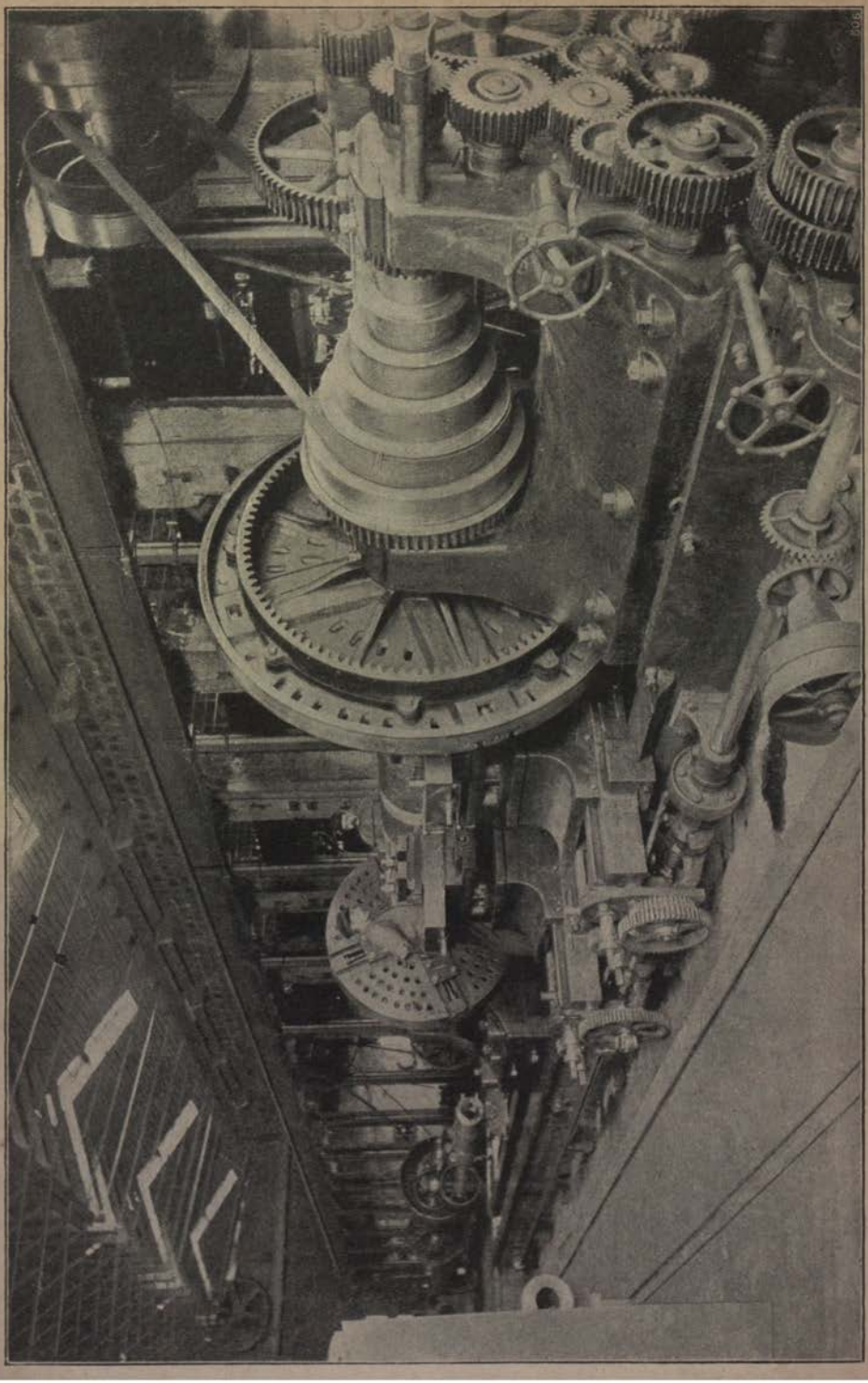
The **Bofors iron works,** situated in the parish of Karlskoga, in Örebro Län, comprise iron works with 2 blast furnaces, 3 Martin furnaces, 10 Lancashire forges, 3 rolling mills, manufacture forge and mechanical works, etc. The Bo-

fors works manufacture blooms, ingots, rolled bar-iron, war material, such as cannon, projectiles, armour plate etc., and steel castings (propellors, etc.). The value of the output is about 5 million kronor per year, and the number of employees is about 1 300.



AGA Lightbuoy from the Aktiebolaget Gasaccumulator, Stockholm.

The **Fagersta** iron works in Västmanland manufacture, in addition to rolling mill products, also saw blades, springs, drawn wire, steel ropes, etc. The **Lesjöfors** iron works in Värmland produce hoop and horse-nail iron, drawn wire and steel ropes. The **Hagfors** iron works, in Värmland, produce tube billets, wood screws, horse-shoe nails, and frost-nails. The **Surahammar** iron works, in Västmanland, manufacture shafts and wheels for railway carriages. The **Kolsva** iron works, in Västmanland, produce various steel castings, such as propellors. The **Hallstahammar** bolt factory, in Västmanland, manufactures exclusively bolts, nuts, fish-plates, and rivets. The **Iggesund** iron works, in Gävleborg Län, manufacture saw blades, planing steels, stone and mine implements. The **Ankarsrum** iron works, in Kalmar Län, produce projectiles. The **Skultuna brass works** at Svartån in Västmanland, which were established as far back as 1611, are owned, together with Granefors and the Nordiska metallverken by the **Nya Aktiebolaget Svenska Metallverken** and manufacture copper and brass plate and wire, bolts, tubes, etc. The **Granefors** copper and brass works, Blekinge, with sheet rolling mill, wire-drawing factory, etc., manufacture tubes, bar-copper, wire, etc. The **Nordiska Metallverken,** of Västerås, manufactures the same kinds of products



The Large Lathe for turning Cannon at Bofors.

as Skultuna and Granefors and also products of aluminium. The total value of the manufactures of the three works now amounts to 22·6 million kronor.

From the above, which only deals with the conditions in a few of the larger establishments, it will be seen that the country *can* produce everything at present used in respect of machinery and tools, etc., whatever it is called or whatever its use, whether in war or peace, from large armoured vessels and the heaviest guns down to the smallest machine tools and implements for working metals, wood, textiles, etc., and for agriculture. As a matter of fact, there are extremely few articles which are not produced within the country. As examples of such, we may mention spinning machines and power looms, etc. in the textile industry, large printing machines, calendering and cotton-printing machines, material testing machines, etc.

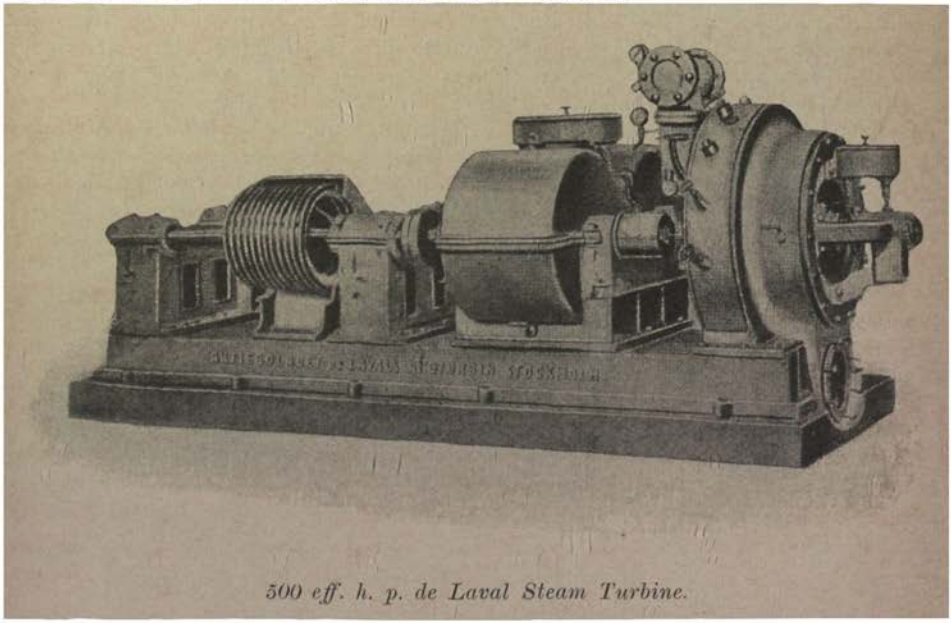
The **difficulties** which the Swedish machine industry has to overcome are in the first place those already named, the lack of coal and of cheap cast iron; the latter, however, will shortly be remedied by the new great coke cast ironworks at Oxelösund. To these may be added the fact that, by reason of the great area of the country, the number of mechanical works, particularly repairing works, has become greater than is required, whereby competition has become keener, all the more so as most of the Swedish works do not export their products to foreign countries. The fact that the Swedish metal industry is thus divided over a large number of, in many cases, quite small works and factories, scattered over a wide area, is, however, of considerable advantage from a social point of view.

As **examples** of manufactures in which Swedish works have shown themselves **capable of competing with the best foreign works,** we may mention the following, although the list is by no means complete. Among those mentioned below, several are based on Swedish inventions, such as de Laval's separators, steam turbines, Diesel motors and petroleum motors, Jonas Wenström's three-phase dynamo, the petroleum stove "Primus". Ljungström's steam turbine, which may now be considered to be the best steam engine in the world, as far as the consumption of steam is concerned, L. M. Ericson's telephones, ball bearings, harvesting machines, petroleum cooking stoves, etc.

Steamships: Bergsund (Stockholm), Kockum (Malmö), Motala, Lindholmen, Gothenburg mechanical works, Eriksberg and Torskog (Gothenburg), Oskarhamn mechanical works, Karlstad mechanical works (steam launches, Karlstad and Kristinehamn) and the Jönköping mechanical works. — **Locomotives:** Trollhättan, Motala, Atlas, Hälsingborg mechanical works, Ljunggren works at Kristianstad, Falun carriage factory. — **Portable engines:** Munktell (Eskilstuna), Kristinehamn mechanical works, Vulcan (Norrköping), Fole (Visby). — **Cycles:** Scania-Vabis, Wiklund, Per From (Stockholm), Huskvarna. — **Steam-engines:** all the works which construct steamships and, in addition, Bolinder, Atlas, Aktiebolaget de Lavals ångturbin, Aktiebolaget Mekanikus (Stockholm), Vulcan (Norrköping), Munktell (Eskilstuna), Jönköping mechanical works. — **Petroleum engines:** Bolinder, Bergsund, Atlas, etc. — **Turbines:** Arboga mechanical works, Trollhättan, Motala, Halmstad. — **Electric motors** and dynamo machines etc.: Allmänna

svenska elektriska aktiebolaget (Västerås), Luth & Roséns elektriska aktiebolag (Stockholm), Nya förenade elektriska aktiebolaget, Ludvika, etc.

Machine tools for working **iron and other metals:** Bolinder, Atlas, Köping mechanical works, Munktell. **Wood-working:** Bolinder, Jonsered factories (near Gothenburg), Skövde mechanical works, Munktell, C. Holmberg (Lund). — **Sewing and knitting machines:** Huskvarna, Per Persson's weaving and knitting machine factory (Stockholm), Stenholm factory for boot-sewing machines (near Jönköping). Machines **for wood-pulp** and **paper factories:** Karlstad mechanical works, Jönköping mechanical works, Hellefors works, Lilla Edet, Arboga mechanical works. For the **peat industry:** Åbjörn Andersson's mechanical works, Svedala. For the **match-industry:** Gerhard Arehn (Stockholm), Siefert & Fornander (Kalmar). For **brick-yards:** C. Holmberg (Lund), Svedala (Skåne), Landskrona new mechanical works, Halldin & Co. (Örebro). For **dairies:** Aktiebolaget Separator, Centrator, Pumpseparator, Svenska centrifugaktiebolaget (Stockholm), Excelsior (Brännudden), Morgårdshammar (Dalarne), Söderblom foundry (Eskilstuna), C. Holmberg (Lund), Ystad foundry and mechanical works, Svedala (Skåne). For **printing works:** Aktiebolaget Mekanikus (Stockholm).



500 eff. h. p. de Laval Steam Turbine.

Sugar factory machines: Kockum (Malmö). **Distilling apparatus:** Holmberg mechanical works (Lund), Svedala (Skåne), Ljunggren (Kristianstad). Apparatus **for breweries:** Ludvigsbergs verkstads aktiebolag, W. Wiklunds verkstäders aktiebolag, Rapid works (Stockholm). **Fire extinguishing apparatus:** Ludvigsbergs verkstads aktiebolag, Aktiebolaget de Lavals ångturbin, Bolinder, Brännudden factory (Vaxholm). **Railway carriages** and other railway and tramway material: Atlas, Gothenburg mechanical works, Falun carriage factory, Kockum, Karlstad mechanical works, Hälsingborg, Landskrona, Södertälje and Ljunggren's works (Kristianstad). **Mill-gearing:** Hessleholm foundry and mechanical works (Skåne), Arboga mechanical works, Morgårdshammar (Dalarne), Söderbloms gjuteriaktiebolag (Eskilstuna).

Agricultural implements in general: Överum works, Kallinge iron and manufacturing works. *Mowing, reaping and sowing machines:* Arvika works (Arvika),

International Harvester (Norrköping), Morgårdshammar (Dalarne), Rottneros works (Värmland). *Threshing-machines:* double-winnowing and sorting: Munktell (Eskilstuna), Thermænius (Hallsberg), Torp mechanical works (Moheda), Aktiebolaget Andrew Hollingworth & Co. (Örebro). *Horse-rakes:* Kallinge iron and manufacture works, Morgårdshammar, Rottneros works, Grönkvist mechanical works (Katrineholm), Stenfors works (Småland). *Ploughs and harrows:* Norrahammar (near Jönköping). *Spades, shovels, hoes,* etc.: Vedevåg works, Stridsberg & Biörk at Gullöfors (Trollhättan), P. Liljeqvist (Eskilstuna), Canell's manufacturing works (Koppom's works, Åmot), Katrinefors (Motala), Svängsta manufacturing works (Svängsta). **Saw blades:** Sandviken iron works (see above), Fagersta, Stridsberg & Biörck (Gullöfors at Trollhättan), P. Liljeqvist (Eskilstuna), Nyby works (Södermanland). **Machine-knives:** Gullöfors, P. Liljeqvist (Eskilstuna). **Edged tools** in general, *skates,* etc.: Tunafors, C. W. Dahlgrens fabriksaktiebolag, Rosenfors, Stålfors, Hadar Hallströms knivfabriks aktiebolag, Erik Anton Berg etc. (Eskilstuna), Hult's iron works (Åby). **Wrought iron for building purposes,** such as window fittings, hinges, locks, stove-shutters, etc.: Aug. Stenman, E. A. Næsman & Co., Lagerbäcks fabriksaktiebolag, C. W. Dahlgrens fabriksaktiebolag, F. A. Stenman etc. (Eskilstuna). **Iron bedsteads:** Svenska järnsängsfabriken, Skandinaviska järnsängsfabriken (Stockholm), Gothenburg mechanical works, Eriksberg mechanical works (Gothenburg). **Lamps:** Arvid Böhlmark's lamp factory (Stockholm), Karlskrona lamp factory, Örnberg & Andersson (Gothenburg) and Aktiebolaget Lux (Stockholm), the last of which has an annual output of the value of 2·5 million kronor and an export over the whole world. **Portable petroleum stoves:** Aktiebolaget Primus (Stockholm) with a sale of 6 million kronor and large export, C. R. Nyberg's mechanical works (Stockholm), etc.

Telephone, telegraph and **fire-alarm apparatus:** Aktiebolaget L. M. Ericsson & Co. (Stockholm). **Clocks, watches** and **taxameters:** Halda watch factory (Blekinge), G. W. Linderoth, F. W. Tornberg (Stockholm). **Umbrella ribs:** See (Gävleborg Län), Grytgöl (Östergötland). **Gymnastic treatment apparatus** according to Dr Zander's system: Göransson's mechanical works (Stockholm). **Cannon:** Bofors. **Projectiles:** Ankarsrum, Bofors. **Rifles:** Huskvarna, Eskilstuna. **Tin-boxes, metal capsules etc.:** Aktiebolaget svenska kapsylfabriken (Stockholm). Tinned or enamelled vessels of **pressed steel-plate:** Olovström, Kallinge (Blekinge), Ankarsrum, Eskilstuna, C. A. Vedholms mejerikärlsfabrik (Nyköping). **Stoves** and heating apparatus of excellent quality are made by a great number of the larger foundries.

Many of the above-mentioned branches of industry have developed during the last thirty years, and prizes have been awarded for their products at international exhibitions. The list could be considerably increased, but from the above it is sufficiently proved that the Swedish machine industry has already advanced very far in the multitude of its products. In this respect it is also pleasing to note that production is taken up with increasing interest both at new and old iron works, so that many of them are in a position to supply horse-shoes, horse-shoe nails, nails, chains, steel-ropes, wire, shafts, and all kinds of rolled and forged products of excellent quality.

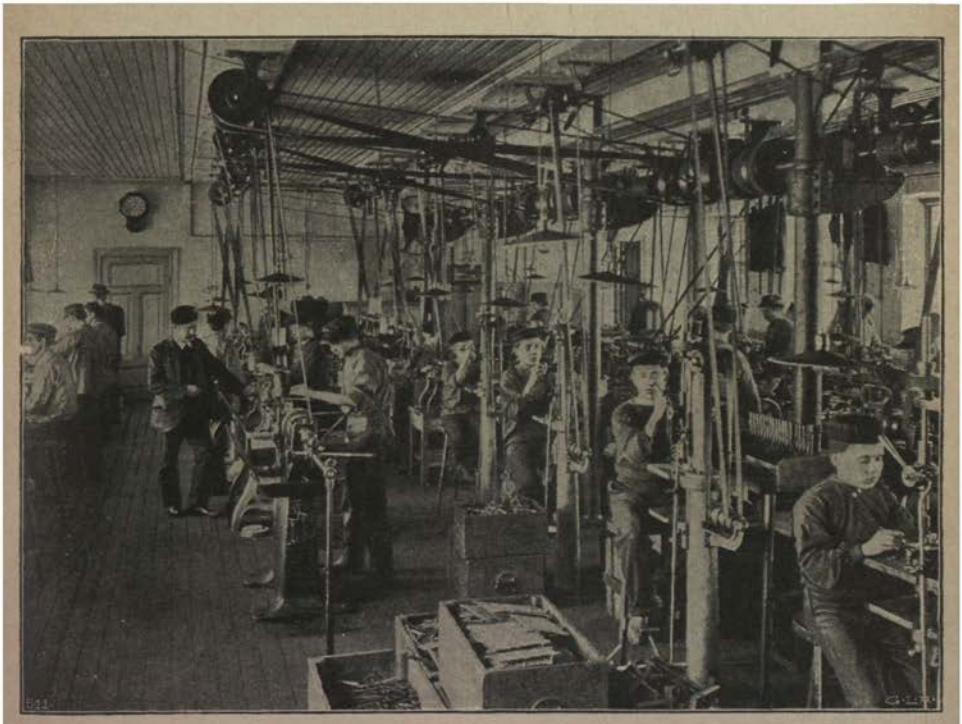
The Eskilstuna Industry.

As this town occupies a special position in the iron manufacture of Sweden, we may here give a few historical and statistical data concerning it. A wrought iron industry in the real sense of the word arose there after the year 1771, when the so-called free town of Eskilstuna was founded and received privilegies. The manufacture of wrought iron was, until the last few decades, carried on principally by hand in small low forges, but the products gained a good reputation and were even exported abroad.

The Tunafors Factories at Eskilstuna.

The so-called Eskilstuna work, which is specially characteristic for the town, includes manufactures of iron, steel, and other metals, such as knives, scissors, hinges, locks, mountings, hooks, and other wrought iron articles for building purposes, files, hammers, tongs, gimlets, saw-blades, pitch-forks, spades, household articles, skates, fancy goods, etc. The Eskilstuna work has, in recent decades, more and more developed into a great industry, inasmuch as the small forges have had to give place to large factories. New and improved machines have been acquired, and during the last ten years alone about twenty new factories have been established. Among the manufactures which have been added in recent years may be mentioned household articles of pressed iron, copper, brass, nickel, and aluminium, automatic blind-rollers, drawing instruments and cases of compasses, steel for chisels and planes, screw tools, and spiral drills of American pattern.

Owing to the efforts of the manufacturers to keep their products on a level with increasing requirements in respect of appearance and quality, the demand in the country for articles of this kind can now be satisfied by home manufacture. A considerable proportion of the finer wrought iron articles was formerly imported, especially from Sheffield (England) and Solingen (Germany). Eskilstuna has also been called, not without reason, the Sheffield of Sweden.



The Tunafors Factories at Eskilstuna. Interior.

The present extent of the metal industry at Eskilstuna and neighbourhood (the parishes of Fors and Kloster) may be seen by the following figures. In 1912 the total number of factories amounted to 113, in which altogether 4 403 workmen were employed, and products to the value of about 17·5 million kronor were manufactured.

Several of the factories also possess foundries and mechanical works, so that Eskilstuna is, on the whole, one of the most important industrial centres in Sweden. The largest establishments are those of *Munktell*, mentioned several times above, and *Tunafors*, which is situated near the town.

In connection with Eskilstuna, we may mention the State rifle factory *Karl Gustavs stads gevärsfaktori*, situated quite near the town, which was established in 1814. It employs 400 workmen and has an output of

1·4 million kronor. It manufactures rifles and carbines for the Government. This and the Huskvarna arms factory are the only rifle factories in the country.

Gold, Silver, and Tin (pewter) Articles.

The official statistics for 1912 include 19 gold and silver factories, with 776 employees and a total output of 2 817 000 kronor. With regard to the manufacture of gold, silver, and tin articles in the Kingdom quantitive returns are also available as far back as 1754, that is to say, probably going further back than in any other country. As early as the middle of the eighteenth century, hall-marks were introduced in Sweden for gold, silver, and tin articles. This hall-marking, which was effected by the *Kontrollverket* (Assay Office), was employed for the articles manufactured in Sweden from 1754 to 1913 to the extent shown by the following table, the quantities being given in kilograms.

Annually	Gold	Silver	Tin	Annually	Gold	Silver	Tin
1754—60 . . .	10·69	3 302	54 344	1851—60 . . .	127·88	4 812	4 780
1761—70 . . .	8·29	2 900	52 408	1861—70 . . .	145·19	3 014	2 490
1771—80 . . .	9·74	2 763	51 259	1871—80 . . .	259·55	2 570	828
1781—90 . . .	19·64	3 476	33 375	1881—90 . . .	292·51	1 630	290
1791—00 . . .	100·83	5 154	28 148	1891—00 . . .	449·62	2 910	90
1801—10 . . .	120·65	3 397	19 953	1901—10 . . .	772·55	6 621	2
1811—20 . . .	95·93	3 761	14 277				
1821—30 . . .	57·33	3 183	10 713	1911	877·11	8 534	—
1831—40 . . .	70·73	3 388	10 445	1912	946·84	9 758	—
1841—50 . . .	88·29	3 811	7 307	1913	1 008·59	10 336	—

During the 170 years from 1754 to 1913, of the articles manufactured in Sweden, altogether 29 113·33 kg of gold, 585 626 kg of silver, and 2 744 040 kg of tin, have been hall-marked. (Tin is not to be hall-marked since 1913.)

The production of gold and silver articles in Sweden has of late years made marked progress. Among the firms engaged in this industry, may be specially mentioned *Guldsmedsaktiebolaget, Möllenborg*, and *Hallberg*, of Stockholm, and *Dahlgren*, of Malmö.

Instruments, Clocks, and Watches.

The manufacture of instruments and clocks has grown to very considerable proportions in Sweden, and there is an important export trade, as shown in Tables 95—97.

In 1912 Sweden possesed 55 **musical** instruments factories with 840 workmen and a production value of 3 305 000 kr. Both organ and piano manufactories have risen to a high state of perfection and the manufacture of organs is of considerable proportions. Special mention may be made of *J. G. Malmsjö aktiebolag* and *Billbergs pianofabrik* in Gothenburg, *Pianofabriksaktiebolaget Gustafson & Ljungqvist* in Norrköping, *Aktiebolaget Östlind & Almqvist* in Arvika, which makes both pianos and organs, and *Åkerman & Lund's* organ works in Stockholm.

There are 4 **surgical** instrument works, with 141 workmen and a production valued at 474 700 kronor. There is an illustration in the article

"Hygiene and Care of the Sick" (p. I, 277) of an operating table made by *Alb. Stille* in Stockholm; this table is considered as attaining the highest degree of perfection known.

The Halda Watch Factory.

Scientific instruments (mathematical, optical, physical, etc.) made in Sweden have attained a very high standard of technical perfection. Several of *Fr. J. Berg's* instruments are renowned. Mention may be made of the levelling instruments, constructed by the founder of the firm and highly esteemed for their easy manipulation and strength. The late instrument-maker to the Royal Academy of Sciences, *P. M. Sörensen,* of Stockholm, has manufactured a number of exceedingly fine scientific instruments, among which may specially be remarked *A. G. Theorell's* meteorograph, which registers temperature, barometric condition, and the velocity and direction of the wind, by means of an automatic pressure apparatus, giving the result, not by means of curves, but of ordinary figures. The apparatus, which is one of the most marvellous of inventions, has come into use in several countries; for example, Brazil has 4; but, on account of the considerable cost of manufacture, its more general use is hindered. — The total number of factories employed in the manufacture of scientific instruments amounted to 15 in 1912, employing 178 hands, and with a value of output of 420 600 kronor.

Among the **watch and clock** manufactories, mention may be made of the *Halda* factory, illustrated above. In Stockholm there are the well-

known manufactories owned respectively by *G. W. Linderoth* and *F. W. Tornberg.* Including factories for the manufacture of clock parts Sweden has 7 watch and clock factories, employing 137 workmen and with an output of the value of 220 000 kronor. The imports and exports are shown in Tables 95 and 97. While on the subject of watch and clock manufacture it may be stated, in conclusion, that the higly esteemed chronometer manufacturer in London, *V. Kullberg*, is a Swede.

II. OTHER INDUSTRIES.

Of the industries comprehended statistics under this heading in the official factory (embracing, in 1912, a total of 814 factories with 11 929 employees and a production value of 59 650 000 kronor), the greater number are of inconsiderable extent. In this category are included, however, establishments for electric lighting as well as the graphic industry, which deserve a more detailed treatment.

Electro-technical Industry.

Whilst, not more than some ten years ago, a considerable part of the electrical machinery and apparatus in use in Sweden was imported, nowadays the home production exhibits a gratifying improvement, with the result that there is now only a very inconsiderable import of electrical machinery; though apparatus, instruments, and installation-material are still imported in rather large quantities. On the whole, there was an excess of imports of about 5·7 million kronor in 1913.

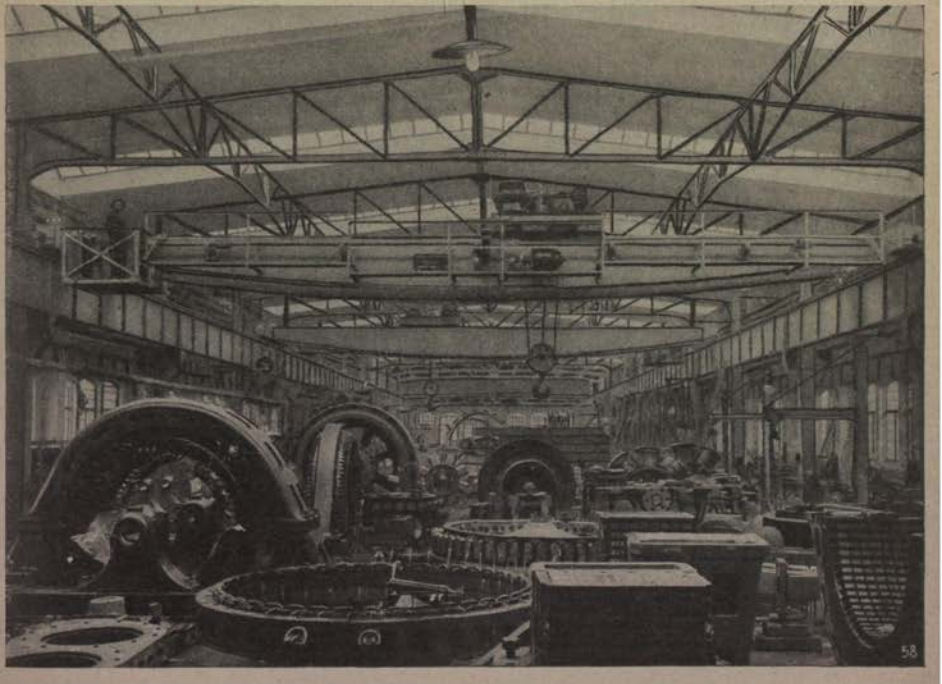
Allmänna svenska elektriska aktiebolaget, in Västerås, is the oldest and largest factory in the country for the production of electrical machines, transformers, and apparatus. The undertaking, which dates from 1883, began its development by taking up and manufacturing the dynamos invented and patented by *Jonas Wenström*, and it has subsequently continued to expand. Electric lifts and cranes, trams, and locomotives are also produced there. In 1913, electrical machines amounting to about 11 000 in number and 460 000 h. p. capacity were constructed there, and the number of hands employed was 3 287. The total turnover was 25·6 million kronor. The company carries on an extensive export trade with the Scandinavian countries, Russia, England, Spain, Canada, South America, and other countries.

Other firms that manufacture all types of electrical machines are *Luth och Roséns elektriska aktiebolag*, of Stockholm (founded 1897) and *Nya förenade elektriska aktiebolaget*, of Ludvika, (founded 1900). In 1912, the latter firm turned out 2 914 electrical machines, with a generating-capacity of 126 390 h. p. The total number of employees amounted to 850. The production of small motors on a large scale has been taken up by *Motorfabriken Eck*, of Gothenburg, who have reached a high standard of perfection with this speciality.

All kinds of electrical apparatus are now produced by the three largest of the above-mentioned firms. Electrical instruments are manufactured by *Graham Brothers*, a firm also known for its electric lifts. Considerable quantities of electric wiring are produced by *Max Sieverts fabriks aktiebolag*, Sundbyberg, and by *Liljeholmens kabelfabriks aktiebolag*, Stockholm. The first-named firm, which was founded in 1888, has also, in recent years, taken up the manufacture of the important articles iron- and lead-armatured cables. The value of the output for 1912 amounted to over 3 million kronor.

Porcelain insulators are manufactured by the *Rörstrand* porcelain factory, and to some extent by the *Gustavsberg* porcelain factory. Insulating tubes are made by *Elektriska rörfabriken*, Södertälje.

Storage batteries are manufactured on the alkali principle by *Nya aktiebolaget Jungnerackumulatorn*, whose products are rather extensively used for electric locomotives, in service within industrial establishments and for similar traction purposes. Lead accumulators are imported.



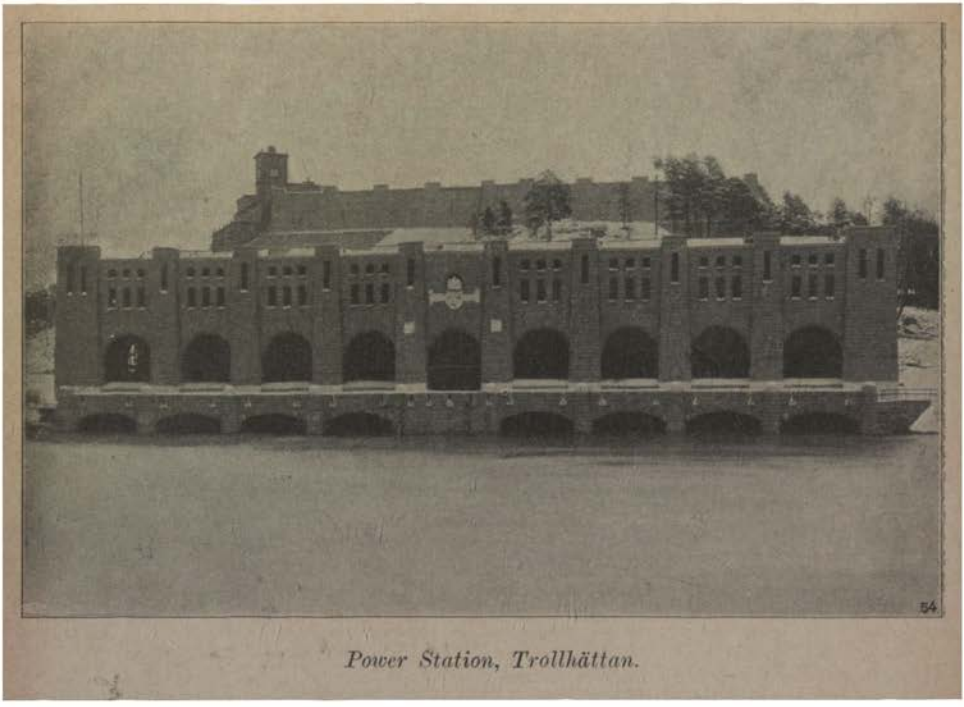
Workshop of the Allmänna Svenska Elektriska Aktiebolaget (A. S. E. A.), Västerås.

Electric Power Industry.

Ever since the introduction of electricity has made it possible to transmit power over great distances, important industrial undertakings have been established, in Sweden as elsewhere, with the object of transmitting and distributing power from central sources. Thus the possession of water-power has, in Sweden, given rise to a power-industry which has greatly developed during the last 20 years. The first really

considerable transmission of power was that effected in 1892—93, between *Hällsjön* power-station and the *Grängesberg* mines. The power transmitted amounted to 300 h. p., the tension being 9 000 volts, and the distance 14 kilometers. During the following ten years, a great number of similar undertakings were started, chiefly for mining and factory service.

At the same time, in a good number of towns and other populous places, local central stations were erected, chiefly for lighting purposes; in some cases they were driven by water-power, though more generally by steam. The first municipal steam central station in Stockholm city was erected in 1891—92. (It may be mentioned as a curiosity that Härnösand was the first town in Europe to establish — in 1885 — an electric generating plant for street lighting.)



Power Station, Trollhättan.

Finally, during the last ten years, a large number of *power plants* have been established, which distribute energy over wide areas of the country to a number of industries and communes, and from whose chief mains secondary supply-lines radiate for the purpose of local distribution, for the lighting of houses, for smaller industrial undertakings, agriculture, etc. The most important plant of this kind is that at the *Trollhätte* falls, which is State-owned and has a total capacity of about 83 000 h. p. In Skåne and the neighbouring parts, *Sydsvenska kraftaktiebolaget* distributes energy over a wide area (including the larger towns). In Blekinge and east Skåne there is a large power-distributing enterprise, *Hemsjö kraftaktiebolag*, and in Västergötland there are two, both

TABLE 98. *Some more Prominent Plants, distributing Electric Energy over Long-Distance Lines.*

Plants	H. p. generated		Transmission-voltage
	Water	Steam	
Porjus kraftverk (owned by the State)[1]	50 000	—	80 000
Sikfors kraftaktiebolag	5 000	—	40 000
Finnforsens kraftverk (Skellefteå city)	9 400	—	35 000
Klabböle kraftverk (Umeå city)	4 525	—	6 000
Forsse fabrik och kraftstation	9 150	—	40 000
Wii elektriska aktiebolag	3 300	—	20 000
Adolf Ungers industriaktiebolag	4 000	—	40 000
Bergvik och Ala nya aktiebolag	2 100	1 000	7 000
Horndals järnverksaktiebolag	8 000	—	20 000
Västerdalälfvens kraftaktiebolag	19 200	—	50 000
Aktiebolaget Ludvika bruksägare	2 870	500	10 000
Älvkarleby kraftverk (owned by the State)[1]	56 250	—	70 000
Untra kraftverk (Stockholm city)[1]	37 000	—	100 000
Värtans kraftverk (Stockholm city)	—	40 000	6 000
Virsbo—Ramnäs kraftaktiebolag	3 045	—	33 000
Guldsmedshytte aktiebolag	6 750	650	33 000
Örebro elektriska aktiebolag	3 100	—	40 000
Kraftaktiebolaget Gullspång—Munkfors	16 950	—	40 000
Aktiebolaget Knutsbro kraftstation	3 420	—	40 000
Skärblacka aktiebolag	4 200	—	15 000
Trollhätte kraftverk (owned by the State)	82 700	—	50 000
Yngeredsfors kraftaktiebolag	8 500	7 750	40 000
Borås stads elektricitetsverk[2]	7 100	1 800	33 000
Stenkvill—Klinte kraftaktiebolag	3 000	—	30 000
Sydsvenska kraftaktiebolaget	27 000	7 000	40 000
Hemsjö kraftaktiebolag	8 500	3 700	40 000

[1] Under construction. — [2] Partly under construction.

of considerable importance, namely, *Kraftaktiebolaget Gullspång-Munkfors* and *Yngereds kraftaktiebolag*. In Table 98 are assembled more de-

Transmission Cost, in kr. per kilowatt, at different Outputs and Distances. 56

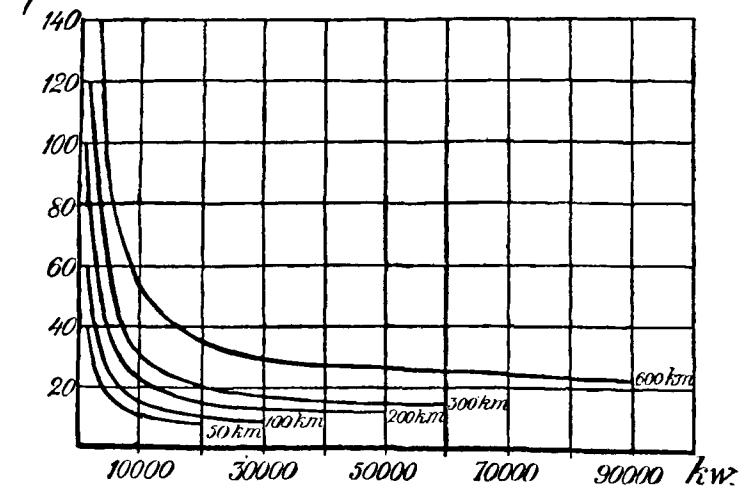


TABLE 99. *Electric Plants and Energy Production in 1912.*

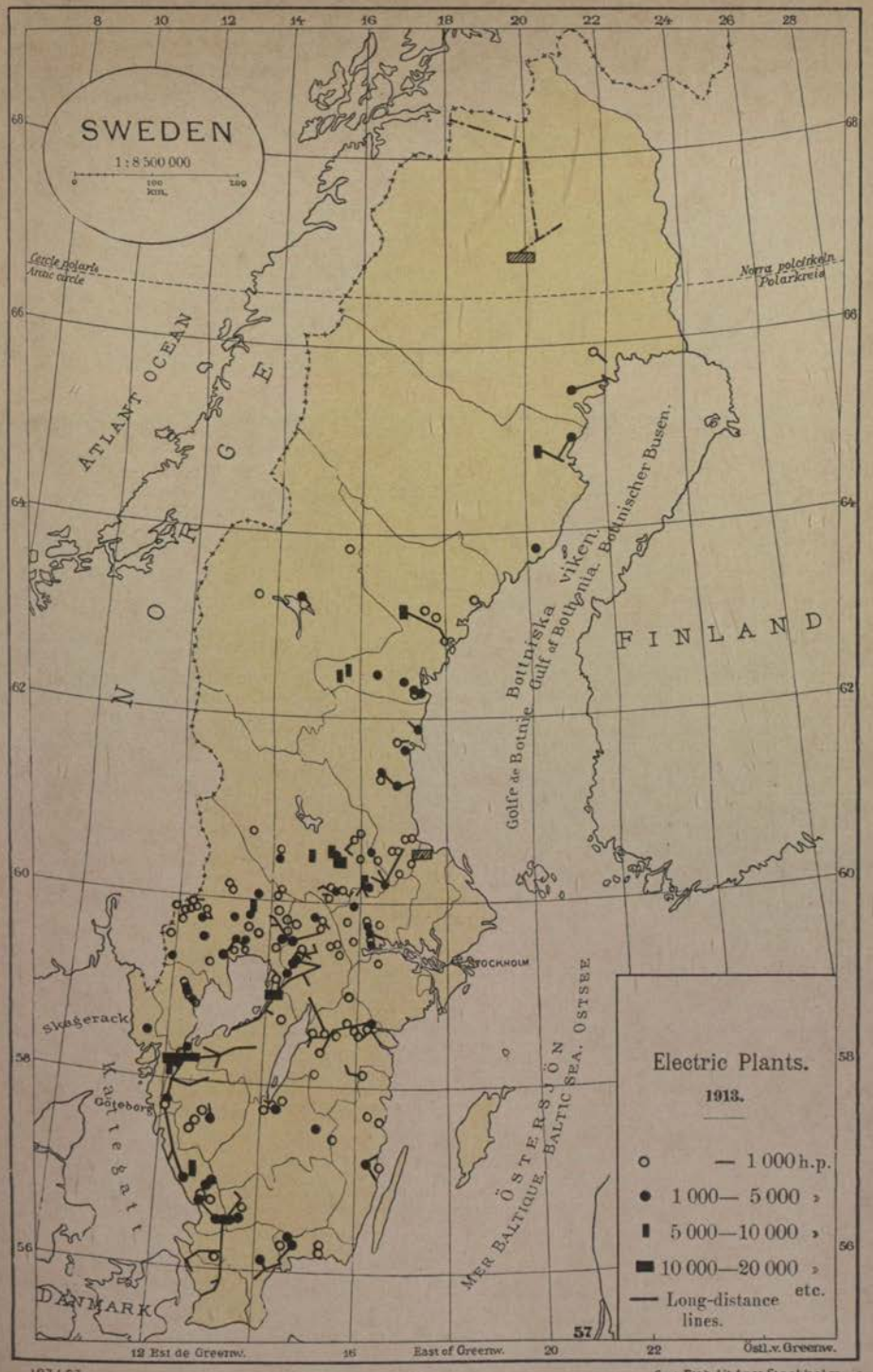
Plants	Number of plants	Driving power h. p. eff.			Total h. p.	Energy prod. Millions of kilo-watt-hours
		water	steam	oil, gas		
Communal central stations and sub-stations	181	15 696	40 670	9 430	65 796	55·69
Power plants (distributing companies and industrial works)	381	416 628	80 277	7 043	503 948	1 055·48
Total	**562**	**432 324**	**120 947**	**16 473**	**569 744**	**1 111·17**

tailed particulars concerning these and a number of other similar undertakings (the figures given refer to the end of the year 1913).

The Generator House of the Trollhättan Water-Power Station.

In Table 99 some figures are given concerning the total electric energy production in 1912. At the same time the total length of the long-distance transmission lines, known to the inspectors of the State, amounted to 6 757 km.

From the figures given can be gauged the great importance of the transmission of electric energy for the industrial development of the country, an importance that will increase more and more with the progress of technics. The highest tension in use is 50 000 volts, but at present (1914) some 80 000 and 100 000 volts transmission lines are about to be installed. In America, however, experience has shown that there are no technical obstacles to the transmission of



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100 000—150 000 volts. With this tension, transmission over a distance of some 500 kilometers can be effected, e. g., from Indalsälven to the middle of Sweden. The cost would not work out particularly high per h. p., provided the energy consumption called for were sufficiently great. The cost of transmission, relatively to the power transmitted, appears from the appended diagram (based on calculations by Centervall and Rossander). The cost is given in kronor per kilo-watt (1 kilo-watt = 1·36 h. p.) per year. In these figures are included the transformation cost at both ends of the line. The shape of the curves indicates how the transmission- (and distribution-) cost rises when less considerable quantities of power are transmitted.

The effective power-cost is the total of the transmission- and distribution-cost, on the one hand, and the production-cost, on the other. In the case of water-power, the production-cost involves interest on the value of the fall, interest on and amortization of the money invested in the construction of the plant. Under the conditions prevailing in Sweden, the construction-cost can (according to engineer Sven Lübeck) be estimated at an average of 250—350 kronor per h. p., giving an annual cost of 25 to 35 kr. per h. p. Thus the price of energy will vary from a minimum of about 25 kr. per h. p., in the case of large supplies for industrial purposes, to 100 kr. and more, in the case of small quantities of distributed energy.

As a rule, the demand for energy from the consumers is not a constant one, but varies from month to month and from hour to hour. A water-driven generating plant, as a rule, is subject to considerable variation in the water-flow according to the time of year. In order to secure something like correspondence between the demand for and the supply of power, it is necessary either to regulate the water-flow — day-regulation by collecting the water in small reservoirs, or year-regulation by damming the water up in large lakes — or the station must be supplied with auxiliary machinery driven by power other than water. Such auxiliary machinery also renders good service in the case of fault on the transmission-line, when placed at the receiver end. Indeed, several of the plants mentioned have erected auxiliary stations, generally steam-driven. Since the production-cost of steam-power depends almost entirely on the cost of fuel, while the cost of water-power chiefly depends on the capacity of the station, a combination of water-power for the normal load with steam-power for peak-load has been found to be a good economical arrangement. This is particularly the case with central stations with light-load, such as communal stations. The light-load generally has a "load-factor" of only about 1 500 hours out of the 8 760 hours of the year, and factories working during the day only require the supply during 2 600 to 3 000 hours in the year. Certain industries, again, such as mills, wood-pulp mills, etc. consume energy during nearly 7 000 hours in the year. These facts, and what has been said above as to the cost of water-power as compared with steam-power, tend to show the economical advantages of water-power in industrial development.

It is also clear from what has been said that water-power in use only for a few hours of the year, as for electric lighting, agriculture, etc., will be rather expensive. In these cases also the rather complicated and expensive distributing systems must set limits to the use of water-power. In more populous districts, however, it has been possible to establish such distribution with economic success, and in several parts of the country electric energy is used for threshing, pumping, etc., in a few cases, even for ploughing.

The use of electrical energy for *electro-chemical* purposes (see *Electrochemical Industry*) and for *electric smelting-furnaces for iron, steel, zink*, etc. is increasing rapidly. For purely heating purposes, such as in houses, electricity is only suitable where the energy can be obtained at a particularly low price (surplus energy).

TABLE 100. *Consumption of Electric Energy in Towns with more than 15 000 Inhabitants. 1911.*

Towns	Opened in	Driving power	Consumers' installation in kilo-watts per 1 000 inhab.				Consumption per inhab. in kilowatt-hours
			light	power etc.	trams	total	
Stockholm	1892	steam	67·03	45·36	16·80	135·10	59·00
Gothenburg	1908	water steam	32·05	37·30	24·80	133·20	122·10
Malmö	1901	water steam	48·81	120·64	19·40	190·08	208·00
Norrköping	1904	water Dieselm.	41·30	41·75	14·76	98·50	54·60
Gävle	1903	water Dieselm.	27·98	32·41	14·15	75·90	30·46
Hälsingborg	1891	water steam Dieselm.	44·39	45·65	10·75	102·00	61·05
Örebro	1886	water	45·39	51·92	—	98·40	85·90
Eskilstuna	1895	steam	13·68	8·12	—	21·96	8·38
Karlskrona	1907	water Dieselm.	29·21	19·10	6·36	54·70	15·48
Jönköping	1907	steam	19·41	11·66	11·90	43·25	19·88
Uppsala	1906	Dieselm. gas eng.	43·17	33·93	14·20	92·40	34·85
Borås	1894	steam water	55·08	58·62	—	113·90	96·68
Lund	1907	water Dieselm.	28·21	40·62	—	79·90	39·90
Västerås	1905	water Dieselm.	33·30	17·30	—	50·60	23·00
Halmstad	1890	water steam	42·87	25·45	—	69·06	36·39
Linköping	1903	water Dieselm.	36·92	52·55	—	90·80	—
Karlstad	1906	water	32·77	64·40	—	98·00	106·80
Sundsvall	1891	water steam	50·34	26·66	23·70	101·06	53·87
Landskrona	1908	water Dieselm.	29·96	74·90	—	105·20	121·92
Kalmar	1908	Dieselm.	19·69	13·52	—	34·60	9·11

A considerable number of local central stations exist in towns, communes, and larger populated places. Not less than 90 % of the towns of Sweden are equipped with electric central stations, most of them being communal undertakings.

In the older town-plants, steam engines, steam turbines, Diesel motors, gas engines, etc., were installed, but later on also water-power was used. In 1909, 75 % of the communal plants depended on water-power; in 64 % heat-engines were installed; thus 39 % worked with combined systems.

At first, electric energy was distributed within towns by means of continuous current, the generating units being paralleled by storage batteries. Nowadays the direct distribution of alternating current has been more and more adopted. Of the above-mentioned townplants, 66 % used continuous current, and 59 % alternating current; thus 25 % employed both systems.

Electric light has become more and more general, thanks to the appearance and improvement of the metal filament lamps. Owing to the small consumption of current by these lamps, electric light has become as cheap as oil lamps. The price for electric energy varies between 25 öre and 45 öre per kilo-watt-

hour (generally somewhere in the neighbourhood of 35 or 40 öre per kilo-watt-hour). The rate for small motors is 15 to 30 öre, generally about 20 öre per kilo-watt-hour. For big consumers a great number of combined rates have been brought into use.

Electric trams are running in ten of the larger towns of Sweden.

In Table 100 are assembled particulars referring to the progress of the electric central station development (from the statistics of the Union of the Electric Generating Industry).

Electro-chemical Industry.

Since the electro-chemical industry has, on account of Sweden's copious supply of "white coal", been called the future industry of the country, we have thought it advisable to deal collectively and from a general point of view with a number of branches of this industry, even though they have been treated in some other part of this work.

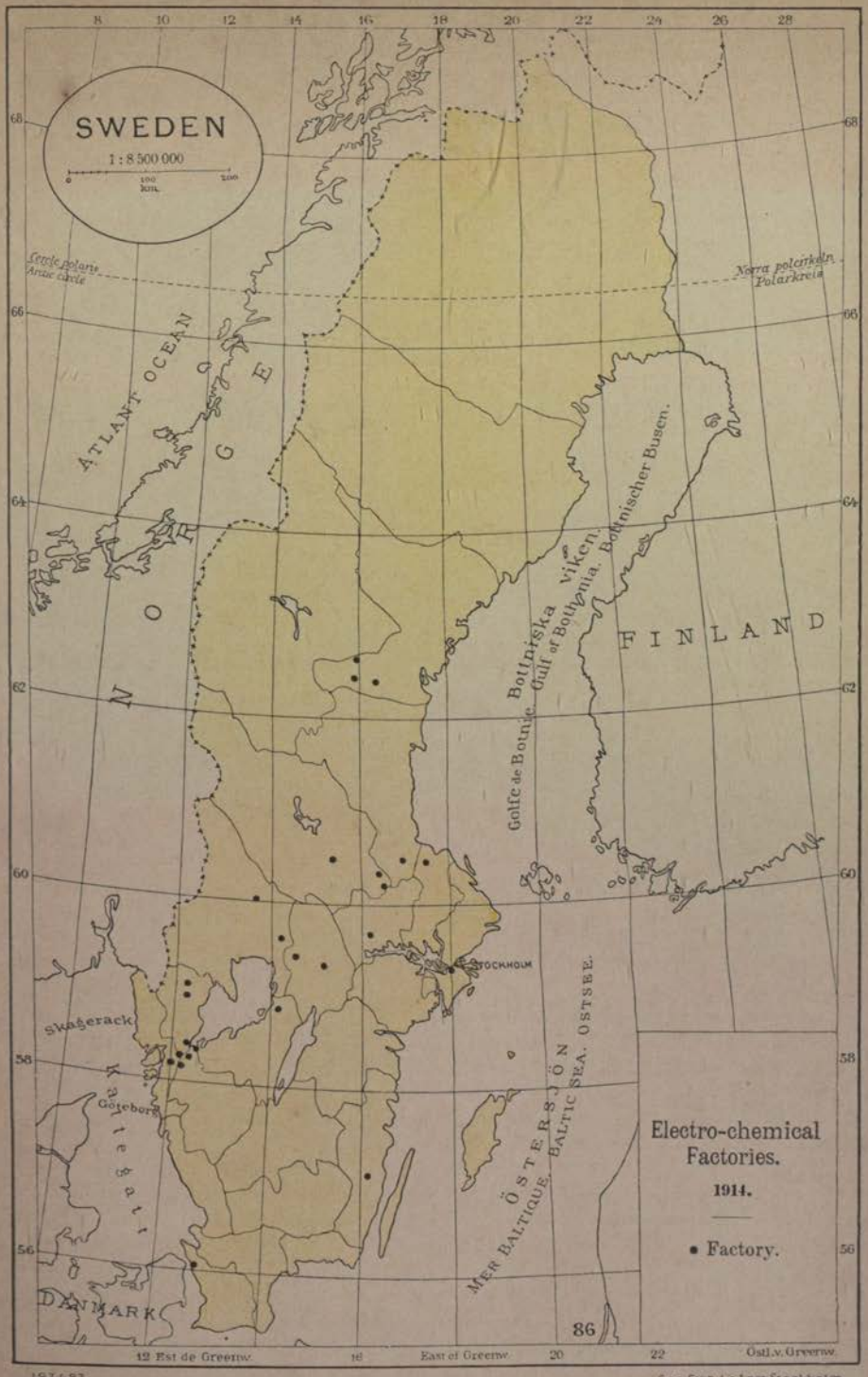
By *electro-chemical industry* is understood, according to established ideas, all industry in which chemical products are obtained with the aid of electricity. Such production can take place in two ways. Either electricity can be employed solely as a source of heat — such processes are called *electro-thermic* — or it is possible to utilize the capacity of the electric current to decompose compounds, by *electrolytic* processes. In respect of the products obtained, it is also possible to divide electro-chemical methods into *electro-metallurgical* methods, which aim at the production of metals or alloys, and such methods as are used for obtaining *chemicals*. For the latter division there is no particularly suitable name.

The electro-chemical industry has developed rapidly in Sweden and is still growing at a quick rate. It would, however, doubtless already now have been of greater importance than it is, had not the water legislation greatly prevented the utilization of the natural resources of the country. This state of affairs has, on the other hand, resulted in the circumstance that only a small proportion of Swedish water-power has hitherto been acquired by foreigners.

After these preliminary remarks, we will proceed to give a detailed account of the Swedish electro-chemical industry.

Electro-metallurgical products. *Pig-iron, steel, and iron alloys.* With regard to the production of pig-iron, steel, and iron alloys (principally ferro-silicon and ferro-manganese-silicon) an account is given under the heading "*Iron and Steel Industry*", see page 263.

Zinc and lead. To produce zinc by heating roasted zinc ore with charcoal in electric furnaces, instead of in small retorts of burnt clay, according to the old-fashioned method, is a very alluring task. The electric furnaces can be built of large size and can be fed continuously; they are also durable, as the charge protects the walls of the furnace against too great heating by the source of heat (electric arc), which is situated in its interior. An economy in the cost of work and in material is thus effected. The heat can further be better utilized, on account of the source of heat being placed in the interior of the furnace. Finally, it does not matter if the charge contains a large percentage of lead (in which case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Bottniska viken.
Golfe de Botnie. Gulf of Bothnia. Bottnischer Busen.
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Skagerack
Kattegatt
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DANMARK
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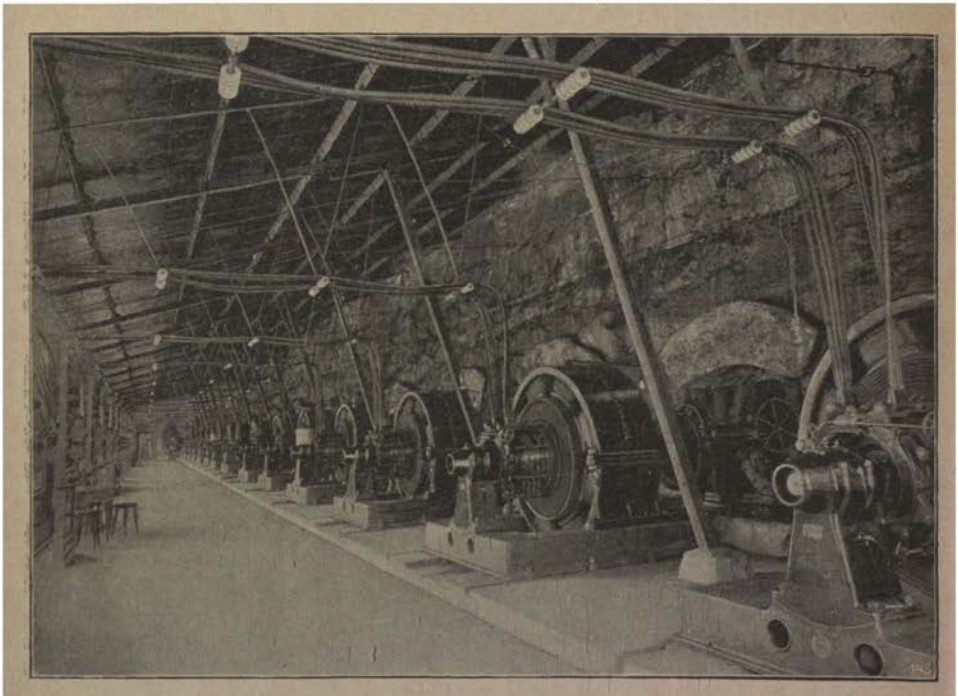
clay retorts suffer damage), as on the contrary, in the electric furnace, the lead is distilled together with the zinc. In spite of the fact that the unit of heat produced electrically is dearer than that produced from fuel, the electric production of zinc has nevertheless been the object of numerous experiments. Among the few which have led to any result are those conducted by the famous Swedish inventor, *G. de Laval*, whose method has, however, now been modified.



Direct Current Generators. Chlorate Works at Månsbo.

The electrical manufacture of zinc is carried on in the country on a large scale by this method at Trollhättan, at the works of the Elektrotermiska Aktiebolaget. This company started in 1910, with a power of 7 000 electric horse-power; in 1912 buildings were constructed for a further 11 000 horse-power, so that the capacity of the works is now 18 000 h. p. A part of the zinc is re-distilled, so as to form zinc of a very high degree of purity (99·95 %), which is used for producing brass and other alloys. A number of iron alloys are also manufactured. In 1911 the production, not including ferro-alloys, amounted to[1]:

	Tons	Value, kr.
Lead (incl. tin-lead and silver-lead)	367	99 000
Spelter	1 572	668 000
Commercial zinc	106	48 000
Pure zinc	2 017	1 059 000

In the year 1913, 6 851 tons of zinc and 191 tons of lead were manufactured.

[1] Values obtained from the factories; not included in the official statistics. Overlapping not excluded.

Silver refining. The Sala mine possesses a small plant for the electrolytic refining of silver, obtained from the argentiferous lead ore of that place.

Chemical Products. *Carbide and Cyanamide.* The Alby Karbidfabriks Aktiebolag was founded in 1901, and its works are situated at Alby railway station, on the river Ljungan, about 95 kilometers to the west of Sundsvall. Immediately to the east of the railway station, the Ljungan forms a fall of 22 meters, from which power amounting to about 7 000 electric horse-power is obtained. The place was formerly uninhabited, but since the carbide factory and the chlorate works mentioned below were erected, a community of about 1 600 inhabitants has arisen at Alby.

The carbide factory uses 5 000 electric h. p. from the waterfall at Alby. In 1907, a further 6 000 electric h. p. was harnessed from the Ringdal rapid, situated about 2 kilometers below the Alby fall, and this power was taken by the already existing carbide factory at Alby, which has thus a total capacity of 11 000 electric h. p. In 1913 the production amounted to 14 008 tons.

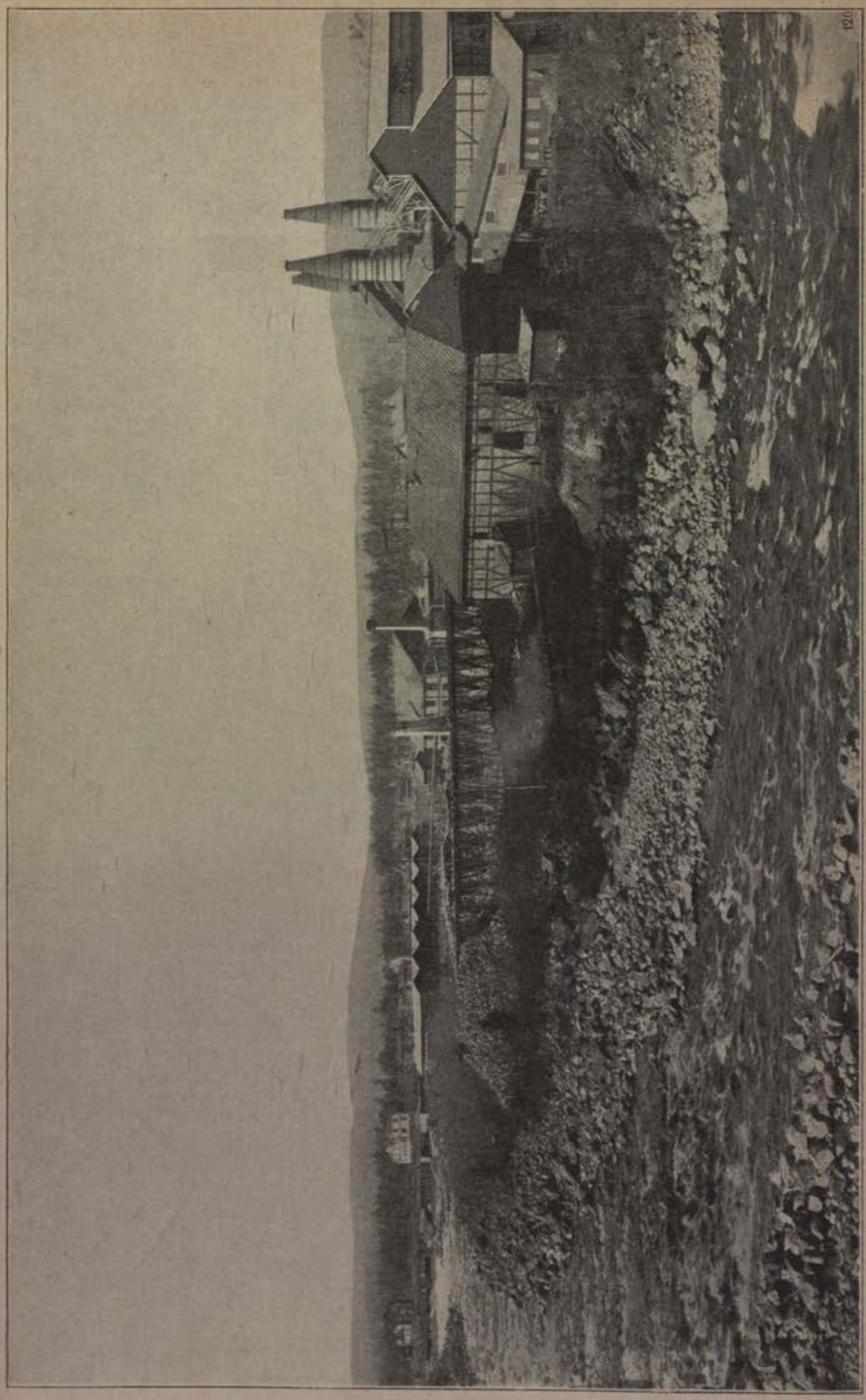
In 1912, a cyanamide factory was also established by the same company at Alby. As is well known, cyanamide is manufactured by heating finely ground carbide, with or without any other ingredient, up to about 900° C. in a current of pure nitrogen, whereupon the carbide gives off half of its carbon in the form of graphite, and combines with the nitrogen to form a compound, the scientific name of which is calcium cyanamide. The mixture of calcium cyanamide, graphite and unchanged carbide thus obtained, together with the impurities of the carbide, is called cyanamide. The percentage of nitrogen may amount to about 20 %, that is to say, as much as in ammonium sulphate and more than in Chile saltpetre (15·5 %). Cyanamide can be ground and used directly as a nitrogen fertilizer, as it is converted by the moisture in the earth into ammonia or salts of ammonia. This direct application is, however, combined with certain disadvantages. For instance, cyanamide must be strewn out a week before the seed is sown, so as to allow time for the conversion to ammonia, otherwise poisonous effects are produced, as a result of the existence of unchanged calcium cyanamide. Unchanged cyanamide is further unpleasant and injurious to handle. It appears, therefore, to be becoming more customary to heat the cyanamide with water or steam, so as to expel the ammonia, which is absorbed in sulphuric acid, to form ammonium sulphate.

The nitrogen used for the production of cyanamide is best obtained by the fractional distillation of liquid air. Numerous organic compounds can also be obtained from calcium cyanamide, such as urea, compounds of guanidine, etc. Saltpetre or ammonium nitrate can now be obtained without difficulty from ammonia.

The output of cyanamide at Alby amounted in 1913 to 16 350 tons.

At the branch of the Stockholms Superfosfatfabriks Aktiebolag, situated at Mansbo, near Avesta, on the Dalälven (see below under the heading Chlorate), a small carbide factory (about 650 h. p.) was established, at about the same time as at Alby. Experiments have since been conducted at this factory for the conversion of carbide to cyanamide. These experiments have led to the establishment of the Ljunga Works by the same company, at the rapids of the Ljunga River, known as Johannesbergsfors and Hångstafors, which are about 40 meters high, and which are situated about 15 kilometers below Alby (see Figure page 428). The power used during the greater part of the year amounts to 18 000 electric h. p. As about 1·5 tons of carbide are produced per electric horse-power per year, i. e., about 2 tons of 20 % cyanamide, it will be seen that this factory has a very considerable capacity.

Before the discovery of cyanamide, carbide was employed almost exclusively for lighting purposes, as it produces acetylene, when mixed with water. This



Carbide Works at Alby.

method of lighting has been used at only a few places in Sweden (e. g., Strömstad, Enköping), one reason being that the waterfalls supply a ready source of electric light. The carbide intended for lighting purposes is, therefore, to a great extent, exported, principally to tropical countries. On the other hand, acetylene lighting has come into vogue to an increased extent for special objects, such as motorcars and cycles, and not least for railway-signals, light-buoys, and lighthouses, in accordance with *Dalén's* inventions, which have been exploited by the Aktiebolaget Gasaccumulator (see p. 452). Acetylene-oxygen blasts are also considerably employed for welding and cutting metals. On account of the production of cyanamide, the prospects of an increased production of carbide have, however, been considerably increased. This is a result of the large demand for combined nitrogen for fertilizing purposes. The present consumption (1913) of Chile saltpetre with 15·5 % nitrogen is about 2 700 000 tons per year, corresponding to 420 000 tons of combined nitrogen, and for ammonium sulphate with 20 % of combined nitrogen, about 1 400 000 tons per year, corresponding to 280 000 tons of combined nitrogen, thus making a total of 700 000 tons of combined nitrogen.

Nitric Acid. The methods of producing nitric acid and nitrate by oxidizing the nitrogen of the air, at a high temperature in electric furnaces, require particularly cheap power and therefore cannot as a rule compete, for instance, with the production of cyanamide, so long as no cheap method is discovered of concentrating the diluted nitric acid which is directly obtained in the process of manufacture. Attempts in this direction seem, however, to have been successful in recent years. As already mentioned, it is also possible from cyanamide to obtain ammonia, and therefrom nitric acid. A small plant for the manufacture of nitric acid for special purposes on the *Birkeland-Eyde* method is to be found at the Ljunga Works, mentioned above as belonging to the Stockholms Superfosfatfabriks Aktiebolag.

Alkali and Chloride of Lime. The Elektrokemiska Aktiebolaget employs at its factory at Bengtsfors, in Dalsland, 400 electric horse-power for the electrolysis of alkaline chloride solutions, using a cathode of quicksilver. By this process are obtained a solution of potassium hydrate (caustic potash) or sodium hydrate (caustic soda), which is converted into solid potassium hydrate or sodium hydrate by evaporation, and chlorine, which is converted into chloride of lime by action upon slaked lime. Of these products, the following quantities can be obtained per year, with the above-mentioned power: 900 tons of 35 % chloride of lime (which at 95 kronor per ton is worth 85 500 kronor), 250 tons of potassium hydrate (which at 400 kronor per ton is worth 100 000 kronor), and 250 tons of sodium hydrate (worth about 50 000 kronor). The total value of the products is accordingly 235 500 kronor per year. This figure is, however, too low, as the alkaline hydrates are sold as pure products.

The electrolytic production of caustic alkalis (potash or soda) and of chloride of lime, which, in other countries, such as Germany and France, has, in spite of unfavourable circumstances, such as dearer power, almost superseded the older purely chemical methods, appears to have prospects of development in Sweden to a much greater extent than has hitherto been the case, especially since the advantage has been seen of combining this industry with the manufacture of wood-pulp. At the same time as alkali is obtained for boiling the wood (by the soda method), the chloride of lime necessary for bleaching the wood-pulp is also obtained; for this purpose, the method of electrolysing a solution of common salt is to a great extent used in America. The building of a new factory for the electrolysis of alkaline chloride solutions has now (1914) been begun by the Stjerns Aktiebolag, at Uddeholm, in Värmland.

Bleaching Liquor (Sodium Hypochlorite). Another form of the electrolysis of common salt takes place in Sweden in connection with the wood-pulp in-

dustry, namely the production of bleaching agents without the use of the alkali. If, on the electrolysis of a solution of common salt, the caustic soda formed at the negative electrode is not separated by a diaphragm from the chlorine which is formed at the positive electrode, and which is fairly soluble in water, and if the products are allowed to meet, particularly if the solution is cold and not perceptibly alkaline, the result is at first a solution of sodium hypochlorite, which is an efficacious bleaching agent, exactly as is chloride of lime, which has an analogous composition.

Such bleaching liquor is produced by electrolysis in Siemens-Schuckert apparatus, at Billingsfors, in Dalsland, by the Billingsfors Aktiebolag, for the purpose of bleaching soda pulp. The plant consumes 400 electric h. p., and the quantity of bleaching liquor produced is sufficient to bleach the annual production of soda pulp, which amounts to 4 000 or 5 000 tons.

Chlorate and Perchlorate. The electrolysis of alkaline chlorides can be carried on in a third direction. When the concentration of sodium hypochlorite has reached a certain limit, it begins to change into sodium chlorate, which is richer in oxygen, while at the same time a quantity of chloride is again formed; this change is promoted by high temperature, and by the solution being as a rule somewhat more strongly alkaline than in the production of hypochlorite. In the electrolytic production of chlorate direct from a chloride solution, a high temperature is therefore maintained, and the solution is allowed to be a little more alkaline than in the manufacture of hypochlorite. The most important chlorate is potassium chlorate, which can be produced either directly by electrolysis of a solution of potassium chloride, or by the electrolysis of a solution of common salt, which is then converted into sodium chlorate; by adding potassium chloride, the less soluble chlorate of potash is precipitated, while common salt (sodium chloride) is again formed in the solution. Chlorate of potash is principally used for the heads of matches, but also for fireworks and for medicinal purposes.

The electrolytic method of producing chlorate of potash has proved so superior to the older, purely chemical method, which consisted in conducting chlorine into warm lime-white and adding potassium chloride to the solution of chlorate of lime thus produced, that the older method has been almost entirely superseded.

The first electrochemical chlorate factory in Sweden, and the second in the the world, was established in 1894, at the branch of the Stockholms Superfosfatfabriks Aktiebolag, at Månsbo, on the Avesta Fall of the Dalälven River. This took place on the initiative of the managing director of the company, *O. Carlson*, who has been one of the most active pioneers of the electro-chemical industry in Sweden (cf. above under the heading Carbide and Cyanamide). He also worked out the method employed. The manufacture is carried on with the use of about 3 750 h. p., and about 2 000 tons of chlorates and perchlorates are produced annually, of a value of 1 270 000 kronor. Chlorate of potash is the principal product, but sodium chlorate and other chlorates and perchlorates are also produced. Of the latter, which have come to be used as explosives, sodium perchlorate is, for instance, obtained, simply by a continued electrolysis of a solution of sodium chlorate. Ammonium perchlorate etc. is obtained by conversion with sal-ammoniac.

Somewhat later (1900), the Alby Chlorate Factory was established at the Alby railway station, on the Ljungan (cf. above under Carbide), on a method originally worked out by *G. E. Cassel*. The factory is now owned by the Alby Nya Kloratfabriks Aktiebolag and employs about 2 000 electric h. p. With a production of 0·7 tons of chlorate of potash per horse-power per year, this corresponds to an annual production of about 1 400 tons of chlorate of potash, with a commercial value of about 840 000 kronor.

The home production of chlorate of potash is more than is required for the country's consumption, and there is a considerable export.

Bicalcic Phosphate. Working on a method invented by V. *Palmær*, the first small factory has been erected by the Aktiebolaget Difosfat, at Trollhättan, for the manufacture of bicalcic phosphate, for use as a fertilizer, with the help of acid and alkali, produced by the electrolytic process. The raw material, which may be very poor, is soaked with acid, where upon the tribasic phosphate of lime contained in it is extracted; the alkali obtained by electrolysis is added to the solution, when bicalcic phosphate, with 35 % of citrate-soluble phosphoric acid is precipitated, and the electrolyte is regenerated in order to be used afresh. The method is principally intended to render possible the utilization of the poor raw material to be found in the country.

Hydrogen and Oxygen. The Nordiska Syrgasverken, Aktiebolag, have, at Örebro, a plant for the electrolytic production of hydrogen and oxygen, by means of Schmidt electrolysers. The power used amounts to 35 h. p. Most of the oxygen produced by the factory is, however, manufactured by the fractional distillation of liquid air.

Galvano-technics. The largest galvano-technical plant in the country is probably the factory for silver-plating, gilding, etc. owned by the Guldsmedsaktiebolaget. This factory has about 350 male and female employees. For silver-plating, 650 kg silver was used in 1912, and for gilding, 3·7 kg of gold. The value of the galvano-technical products of the factory in the same year amounted to about half a million kronor. In addition to this factory, there are a number of smaller works for silver-plating, gilding, and nickel-plating, and for the manufacture of stereotype plates.

Accumulators and Galvanic Cells. The manufacture of accumulators and galvanic cells should, in reality, come under the heading of electro-chemical industry, although it is not included in the definiton of this industry, which is consequently, like most definitions, not quite exact. In this branch of industry may be mentioned the accumulator invented by the Swede *E. W. Jungner*, of which, when charged, the active parts are, on the one hand, iron sponge and, on the other hand, nickel oxide, and, as electrolyte, a solution of potash. Edison has also arrived at the same system, although the two inventors have worked independently of each other. The great advantages of Jungner's accumulator are its insensibility to shaking and the fact that it requires little care in manipulation; in a word, that it is more durable than the lead accumulator and can therefore be employed for a large number of so-called traction purposes, for which the lead accumulator is unsuitable. It is manufactured by the Svenska Ackumulatoraktiebolaget Jungner in their factories at Fliseryd in Småland. The main use is for accumulator locomotives, train lighting, submarine batteries, and other transportable batteries. The value of the output is one million kronor a year, about a 100 000 cells a year being produced. At present the capacity of the factories is about 2 million kronor.

Among the manufacturers of galvanic cells (Leclanché cells, dry cells) in Sweden may be mentioned Rylander & Rudolphs Fabriksaktiebolag, Henriksdal, Stockholm.

Carbon Electrodes. The manufacture of carbon electrodes for electric furnaces is carried on by the Höganäs-Billesholms Aktiebolag, which in 1913 turned out 1 870 tons of electrodes to the value of 430 000 kronor, and by the Aktiebolaget Héroults Elektriska Stål of Kortfors, which in 1913 produced 167 tons to the value of 39 800 kronor.

The table given below shows an estimate of the extent to which the electro-chemical industry in its entirety, i. e., including the electro-metall-

urgical industry, has hitherto developed in Sweden. The galvano-technical industry, together with the production of accumulators and galvanic cells, is, however, not included in the table.

Year	Number of Establisments	Electric horse-power employed	Value of Production, kr.
1904	8	12 000	4 500 000
1908	10	18 000	7 500 000
1911	13	33 000	11 000 000
1913	22	80 000	20 000 000

The value of the output is still small in comparison with the total production of the country, but it is the rapid increase which is so remarkable. That this industry will continue to develop largely and will contribute greatly to the economic prosperity of the country would also appear to be beyond doubt.

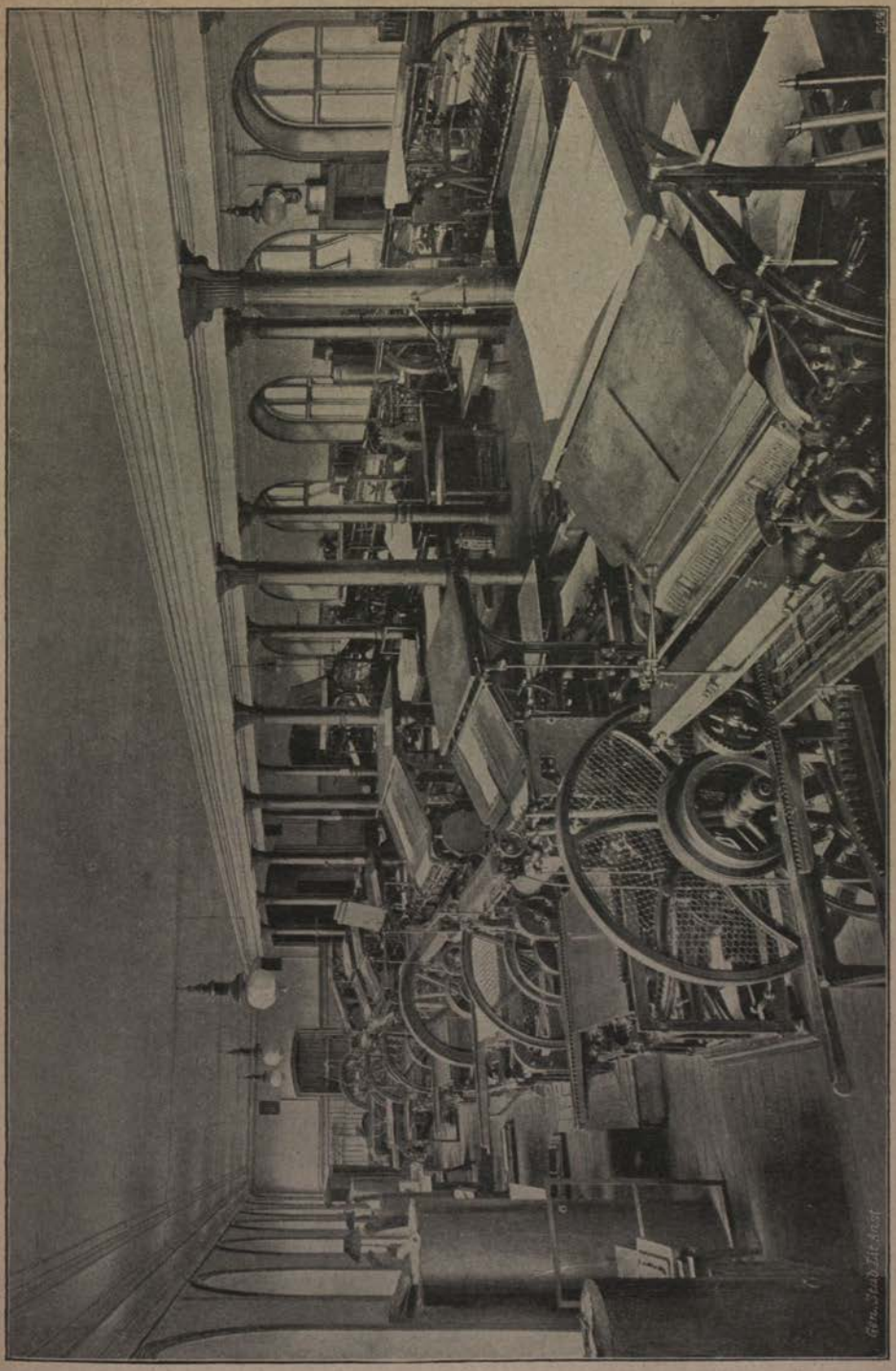
The accompanying map illustrates the electro-chemical establishments in the country.

Graphic Industries.

Printing-offices. The art of printing was early introduced from Germany to Sweden, where, in 1483, a printing-house was established in Stockholm. The first book printed in Sweden — a legend of saints in Latin — was issued that same year from the said printing-house, and the first book printed in Swedish was published in 1495. In the Vadstena monastry, founded by St. Bridget, a printing-office was set up the last-mentioned year, but it was burnt down the same year. During the 16th century, printing-works were founded in Uppsala and Stockholm, and during the 17th century in several other towns in Sweden. At the beginning of the 18th centruy, Stockholm possessed six printing-offices and Uppsala had two, but at the beginning of the 19th century, the whole country still possessed no more than 50. Later on, however, the development was much quicker. In 1912, Sweden had 421 printing-houses with more than 2 350 printing-presses. The number of typographers amounted to 7 223, and the value of production is given at 23 738 000 kronor, — certainly too low a figure.

The increased numbers and capacity of the printing-offices was accompanied by the introduction of printing-machines and then of type-setting machines. In 1829 the first stop-cylinder press was brought into the country, and the number of hand-presses has gradually declined, so that they are now used only exceptionally. That platen machines have come into extensive use and increase in number year by year need hardly be mentioned.

For the printing of newspapers ordinary *stop-cylinder presses* were long in use; in the sixties and seventies, when the issues began to increase, they were, however, succeeded by French *double-presses* (by



From the Government Printing-Office in Stockholm (P. A. Norstedt & Söner). Printing-room.

Marioni or Alauzet). But the newspaper issues continued to increase, and in 1881 the first *rotary press* was introduced, which has since been followed by more, so that the number of them now (1914) amounts to some 60. Several machines, of English and French origin, are constructed for printing in two colours.

The first *composing-machine,* Linotype, was imported from America. At present 607 type-setting machines are at work, of which 400 Linotypes from America, England or Germany, 207 Typographs from Germany.

The largest printing-house in Sweden is the *Government Printing-Office* (Kungl. Boktryckeriet, P. A. Norstedt & Söner) of Stockholm, where this book has been printed. It is owned by a joint-stock company, P. A. Norstedt & Söner, which is at the same time the largest publishing-house in Sweden, for which reason the firm, besides printing official documents, carries on a publishing business of its own. The firm, founded in 1823 and turned into a company in 1878, gives occupation to 700 hands and makes use of 28 printing-machines, of which two are rotary. Next in size comes the *Central Printing-Office* (Centraltryckeriet), founded in 1874. The production value in 1912 amounted at the Government printing office to more than 2 million kronor, and at the Central Printing-Office to 2 200 000 kronor in 1913. The latter company employs 90 machine printing-presses and 13 hand-presses. 450 hands are employed.

Among the newspaper printing-offices, the size of which is chiefly dependent on that of the respective issues, the chief are those of Aftonbladet and Stockholms-Tidningen.

Of **type-foundries** the first in Sweden was established already in 1739, but at present they are of comparatively little importance. Generally they belong to the printing-offices and generally also make stereotypes and electrotypes.

At the very first appearence of the *photographic* methods of reproduction their great significance was understood in Sweden, and establishments were founded for their application. To begin with, the result did not prove altogether a success, but by perseverance the work has now advanced so far that **clichés** made in Sweden can be considered very satisfactory.

Lithographic and phototype establishments. For the production of plates, particulary for scientific purposes, lithographic establishments were founded at an early date, and their number steadily increased till the end of the eighties, when the competition of the printing-offices began to make itself felt. In 1912, there existed in Sweden 40 Lithographic institutions with 1 451 workers and a production value of 4 142 000 kronor. The greatest was the *Lithographic Joint-Stock Company of Norrköping* (Norrköpings Litografiska Aktiebolag), which chiefly produces mercantile prints in large issues to a value (1914) of about 2 300 000 kronor. Then come the *Lithographic Printing-Office of the General Staff* (A. Börtzells

tryckeriaktiebolag), which mainly prints maps, scientific plates, and photographic reproductions, especially all the official maps of Sweden, with a production value of 600 000 kronor, and the Lithographic department of the *Central Printing-Office* for music, securities, and mercantile documents.

The *phototype* establishments, as a rule, form part of the photo-chemigraphic establishments and are chiefly employed in the reproduction of works of art and scientific prints, as well as of photographs.

An important economic amalgamation in this domain is the *Aktiebolaget Sveriges litografiska tryckerier*, Stockholm 1913.

12. HANDICRAFTS AND DOMESTIC INDUSTRIES.

Handicrafts.

The main features of the history of *handicrafts* in Sweden, as far as regards its earlier phases, and those of the Middle Ages in particular, may be said to be connected with the rise and development of the guild-system, as, in consequence of German and also, in part, of Danish influence in the country, the system in question was introduced into Sweden, and the way thereby prepared for the promulgation of guild-regulations, which, as in Germany, were calculated to enable the masters of the handicrafts to pursue their work profitably and also to obtain for them certain social privileges.

Just as elsewhere, Swedish professional handicraft traces its origin from the domestic industries of the *towns*, where a more numerous population could make division of labour advantageous and supply special craftsmen with enough customers to secure them a living.

The attention devoted to the well-being of the towns caused the authorities at an early period to attempt to concentrate in them trade as well as handicrafts; a letter written by Duke Valdemar in 1315 contains instructions on this point. The common law of the rural districts (country law of 1347), however, grants the artisans the right of carrying on their trades in these districts, and the urban (borough) law did not forbid this at any rate; only goldsmiths were at this time absolutely enjoined to live in towns.

The first noteworthy technical progress of handicrafts, as well as the legal forms, by which they were controlled down to our own days — **The Guilds** — Sweden chiefly owes to *foreigners* — i. e., to those German craftsmen who, after the middle of the 13th century, came to settle in the larger Swedish towns. As early as in the town-law of the city of Visby, on the island of Gottland, more than twenty different guilds are enumerated; in the other parts of Sweden this institution was most probably not introduced till the beginning of the 14th century. The oldest Swedish guild document in existence is King Magnus Erikson's letters patent of 1356 to "the Tailors' Company" in Stockholm; the oldest guild regulations are those for the Stockholm shoemakers (earlier than 1474). The guild regulations for the capital were probably also in force for the craftsmen of country towns.

A *native* artisan class was the fruit of the industrial policy of King *Gustavus Vasa* (1523—60), the principle of which was to effect a beneficial division of labour among the various leading trades as well as among the various minor branches of these trades. For this purpose artisans were forbidden to engage in commerce or to carry on more than one trade; merchants were forbidden to carry on a handicraft; nor were merchants allowed to import from abroad such manufactured goods, by the import of which the town artisans might be "ruined". To carry on a craft it was necessary to be vested with the rights and privileges of a burgher and to be a member of a guild. The endeavours of the Middle Ages to concentrate the trades in the towns were taken up afresh and in greater earnest. The rural districts were, however, allowed to keep their "tailors, shoemakers, skinners, blacksmiths, and carpenters", who were considered indispensable. Another exception was occasioned by the King's right of appointing "free-masters", who were permitted to carry on their trades independent of guilds and burghership. This privilege was generally granted to foreigners, as there was still a complaint of the lack of clever Swedish craftsmen, which still remained the case during the reign of King *Johan III* (1568—92).

The next stage of development is marked by a still greater favour shown to the towns at the expense of the rural districts and by an increasing rigour in the enforcement of the rule making membership in the guilds obligatory. *Charles IX* (1599—1611) fixed the number of artisans for each hundred (härad), and as early as 1576 he ordered all the guilds of his duchy to be close, i. e., they were to have a certain number of masters proportionate to the population and size of the town. The town artisans obtained a monopoly of work inside the town and within a Swedish mile (6 English miles) radius outside of it, but they were not allowed to work beyond that limit. To exercise a craft it was required, that the masterpiece should have been approved by the bailiff, the council, and the alderman of the guild, which authorities, moreover, were to exercise superintendence over the guilds, examine the wares, and fix a suitable price for them. In the same spirit, or a still severer one, (the extension of "the mile of freedom" to two miles, the stricter requirements respecting apprentices and journeymen, etc.), Charles, when king, issued guild privileges for special crafts as well as for whole towns.

Gustavus Adolphus (1611—32) went even farther than his predecessors in his attempts to restrict the pursuit of crafts in the rural districts. Country artisans were not now allowed to work at less than four Swedish miles' distance from a town, whereas urban artisans, with the knowledge of the alderman, had permission to work for the country people. In 1644, liberty of trade in the rural districts was restricted still more, so far even that all craftsmen in the country districts had to apply for burgership of the cities and to pay taxes there. If urban crafts had thus been almost completely delivered from the rivalry of the rural districts, they were, however, threatened with a more dangerous intrusion from another quarter. The *Nobility privileges* of 1612, as well as those of 1617, granted a nobleman the full right to keep any number of artisans he might need, and to hold his domain free from all the impositions of Crown and Town, unless the people living on the estate carried on a townsman's craft. In this way the nobility found a pretext for "protecting" from taxes and military conscription a number of "handicraftsmen" in the rural districts who were working there for other people, as also for releasing a number of artisans in the towns from all kinds of taxes. The attempts to check this undue interference did not lead to any satisfactory results.

On the other hand, the new statutes of 1621 and 1622 do not recognize any close guilds, though some older ones were kept up in many places, and

the sole right of the guild to examine the masterpiece of an applicant considerably restricted competition.

It is also about this time that voices are heard against the obligatory membership of guilds, as a remedy against the unreasonable prices of craftsmen's goods. *Axel Oxenstierna*, Sweden's real regent during the years 1632—44, enforced the holding of open markets, in Stockholm and Kalmar at least. But the promises of Government to amend the guild statutes remained unfulfilled. The only thing done during the reign of *Christina* (1644—54) was the appointment (in 1653) of a commissioner to inquire into the reform question, to inspect all kinds of manufactured articles, and, in general, to exercise superintendence over the artisans. The decree was renewed in 1662, and the activity of the guild commissioner was now placed under the control of the Board of Trade. A new general statute for the guilds was also issued in 1669. By it close guilds were expressly forbidden; any one who honestly and well had learnt his trade was to be admitted as a master. On "masterpieces" and most other concerns of the guilds, the guild should not decide alone but in concert with the mayor and the council. No meetings were to be held without the permission of these authorities, and at each session one of the magistrates, "the guild magistrate", was to be present. In 1672, the right was granted to artisans to settle as free-masters at Kungsholmen, close to Stockholm.

The reign of *Charles XI* (1672—97), on the contrary, seems to mark a reaction as far as the guilds are concerned. During his time, even close guilds were sometimes allowed, and the prohibitions — after falling into disuse in the regency during the King's minority (1660—72) — against the interference of "protected men", were now re-enforced. As to the country districts, Charles XI entertained a more liberal opinion, however; to each parish was given the right of keeping one tailor and one shoemaker; the larger parishes were allowed to have several. Against a fixed payment to the Crown, these artisans were also relieved from all taxes hitherto accruing to the towns and from the duty of applying for burghership in them, and they were also shielded from any action that might be brought against them by the guilds.

The decline of industry and the high prices of craftsmen's goods during the last years of *Charles XII* (1697—1718), were essentially attributed to the guilds. One of the first measures of the new political era was, consequently, the statute of 1719 concerning free-masters. Every one that had learnt a trade should be allowed to pursue it, after giving notice to the magistracy and being vested with the rights and privileges of citizenship. The reform, however, was too radical to be of long duration; the very next year, the right of free-mastership was, by the new guild ordinance, limited to immigrating foreigners. In spite of protests from the burghers, the ideas of liberty certainly made headway again in the statute of 1724 concerning free-mastership for natives as well as foreigners, but reaction was soon in full sway, and in 1731 it was decreed that no native-born free-masters of such trades as stood under a guild could be admitted to the towns. In opposition to the explicit direction of the guild-ordinance, the *making of the guilds into close bodies* followed in 1734; for the prevention of poverty and the unauthorized carrying on of the crafts, no larger number of craftmasters should be admitted than the magistracy and the respective guilds considered expedient and necessary. In 1739, these retrogressive efforts were crowned by a prohibition against the free-masterhip of foreigners too. With this step legislative action concerning handicrafts was for the time brought to a close; henceforth, it is the regulation of *industrialism* that attract our chief attention.

During the year just mentioned (1739), a new *hall-statute* was issued (to replace that of 1722), as well as new *manufacturers' privileges*. Released from

the duty of belonging to any guild, but subject to the Court of Industry (Hallrätt) should be: all silk, woollen, and linen manufactories, together with all the works and factories belonging to them, "as well as other manufactories and artificers, of whatever name they may be, who choose to place themselves in subjection to the Court." In the quarrels, called forth by this most indefinite wording, between guild craftsmen and manufacturers, the authorities sided with the latter, while the former continued to be favoured at the expense of the rural artisans. Even in 1723, the old difference between town and country trades — essentially done away with by the wars — revived again; all craftsmen had to return to the towns, with the exception of those who were engaged by the year in the service of the nobility, or who, in their capacity of parish or factory artisans, were entitled by law to live in the country districts. In 1734, it is true, the farmers obtained the right of carrying on handicrafts as by-trades and of selling their own articles, as well as those made by others in general, anywhere they pleased, but the categories of handicraftsmen proper increased but slowly.

Complaints of the exorbitant rise in guild prices called forth in 1762 an ordinance requiring the value of the goods to be fixed by impartial persons, this replacing the regulations of 1720 concerning the election of valuers from among the members of the guild. The valuation was now to be performed by one magistrate (not a guild magistrate), one merchant, one broker, and one guild artisan, who had to state their decision before a court, after which the matter was to be settled "summario processu".

The accession of *Gustavus III* (1771—92) again accelerated the reform agitation. By the rescript of 1773 it was decreed that the regulation in the guild statute of 1720 concerning a journeyman's right to become a master should be observed without any alteration, and that thus no journeyman, after having served the prescribed time, should be denied mastership and burghership. After hearing the parties concerned, the magistracy was to decide what masterpieces an applicant had to execute, and what fees had to be paid. Married journeymen, who wished to become masters, were guaranteed a reduction in the term of journeymanship amounting to one or two years. The subsequent industrial policy of the king long remained decidedly liberal. Under the administration of *Liljencrantz* as Secretary of State, the organization of "free towns" (begun in 1766) was continued and extended, and in these towns "real" articles of manufacture in the iron and steel branches might be produced without any masterpiece test. This liberty was now to be extended to all kinds of tradesmen in the new towns henceforth founded. All reformatory plans were, however, interrupted by the resignation of Liljencrantz. The king's need for the assent of the burghers to a new Constitution (1789) forced him into another course of industrial policy. By a proclamation of 1789 to the burgesses of the kingdom, it was enacted that nobody should carry on a burgher's trade or business that had not been vested with the rights and privileges of citizenship (but with the exception of those granted to nobility and gentry), and that, in case a greater number of craftsmen should present themselves than might reasonably be expected, to be able to find their livelihood, due regard should be paid to the opinions pronounced on the point by the company, the elders of the town, and the magistracy. Another resolution annulled the right of admitting craftsmen conferred upon the universities (by former constitutions) and upon public offices (since 1739) and forbade the "courts of industry" to bring under their control journeymen and soldiers, so that these could keep joint workshops, although the latter retained their privilege of working in a guildmaster's workshop or on his account. As early as 1790, it was enacted that this liberty of work granted to the soldiers (which, in 1804, was extended to the country

militia) should also be granted to workmen at rifle manufactories and salt-petre works, etc., as well as "to other persons in the works and on the estates of the Crown", besides which the universities, in 1791, regained their right of appointing craftsmen; but the declaration of 1789 remained in force and rendered journeymen's right to mastership very difficult to obtain. On the other hand, the freedom of handicrafts in the rural districts was extended in 1802. On the representation of the governor of a län, the Government should henceforth in every special case be entitled to examine whether other artisans than those already admitted by law could be admitted in the future. In consequence of such special concessions, there were thus, in 1843, at various places, craftsmen in no less than 26 trades in addition to the five original ones, (tailors, shoemakers, smiths, masons, and glaziers).

After the introduction of the *new constitution* (1809), the development towards free trade found its first legal expression of any importance in the two ordinances (of 1821 and 1828) by which was settled the old matter of dispute concerning the limits of the respective spheres of work for guild artisans and for manufacturers. It was now stipulated that the protection of the *manufacturing privileges* was to be granted by the Board of Trade: *a*) to those who had duly proved their ability to manufacture either such articles as were not made within the guilds or else such as were of a better quality than those generally made by the guild masters; *b*) also to those who, at a manufacturer's, had gained a complete knowledge of his trade, and who, according to the certificate of the proper magistrate or "court of industry", were clever enough to work on their own account. Such a manufacturer was to have the right to produce all kinds of goods within the trade of which he had obtained the privileges; the same liberty of work was to be enjoyed by manufacturers already appointed and their workmen. In 1828, the clauses of the guild ordinance were declared to be no longer applicable to brewers, bakers, and butchers in the towns, and in several new towns and boroughs the same liberty was granted handicrafts in general. In 1845, the parishes obtained the right to decide what kinds of artisans ought to be allowed to exist in them.

Then in 1846, followed the **abolition of the guilds.** In their place were to be instituted free handicraft unions to promote the interests of the artisans. The right of exercising a trade as a master was made dependent on several civil qualifications and, for most trades, on the obligation of having qualified as a master; burghership was required, besides, to keep a workshop in town. But any trade might be carried on in the country, and it became permissible to carry on several trades at the same time. The right was granted, besides, to every respectable Swedish man that had reached his majority, of manufacturing goods with the assistance of his wife and such children as were living at home, even although he had not become a master or a citizen of any town — this right was, moreover, extended to women. **Complete freedom in carrying on trade** was established in 1864.

Shortly after the promulgation of the liberty of trade ordinance of 1864 the artisans discovered that this unrestricted throwing open of trades and crafts was not a good thing, and before many years had passed, the question began to be discussed at meetings of industrial workers, whether this extension of liberty of trade was in agreement with the claims that tradesmen and craftsmen considered themselves to possess, and what alterations of the act were to be considered necessary.

There were, properly speaking, three details in the act in question on which criticism was concentrated. The first was § 2, in which

the only claim laid on those that wished to follow a trade or craft was that they should be of good character, and that they themselves and their property should not be under the control of any other person.

The second was the regulations in §§ 13 and 14, where, in contrast with the requirements of the enactment of 1846 regarding those that established factories or followed a craft, it was left to the workers themselves to decide whether they should form unions or not.

The third objection was directed against the absence in the act of regulations enabling the followers of a trade to train workmen to become skilful artisans.

Ever since the beginning of the decade 1870—80, i. e., only a few years after the grant of the formerly so much longed for freedom of trade, the above-mentioned defects in the law have made themselves felt with undiminished force, and this is the more remarkable as the alterations made in the above-mentioned details may be considered as the chief points in the act of 1846. As a matter of fact, they may be regard as relics of the guild-system, whose constitution, among other things, was distinguished by regulations concerning a) the ability necessary for being allowed to follow a trade, b) the formation of unions or associations, and, c) the training of apprentices and journeymen. At the present time, there seems to exist a general desire to renew in some modern form, among other things, the regulations determining the skill that an artisan should possess before being allowed to carry on his trade, just as in Germany, where such a rule has already been established (Befähigungsnachweis). Of late years, as a matter of fact, propositions have been made to this end.

TABLE 101. *Factories and Handicrafts*[1].

Year	No. of factories and handicraft establishments		No. of workpeople belonging to		Total no. of handicraftsmen and their workpeople	Assessed Income. Millions of kronor	
	Factories	Handicraft establishments	Factories	Handicraft establishments		Factories	Handicrafts establishments
1899	10 364	42 350	257 526	43 023	84 373	74·20	25·33
1900	10 549	44 517	265 479	42 805	87 332	74·55	26·78
1901	10 904	48 038	262 229	44 315	92 353	75·22	29·35
1902	10 978	51 089	263 244	45 319	96 408	69·42	30·63
1903	11 588	53 077	271 157	47 741	100 818	69.94	31·87
1904	11 962	54 831	277 853	49 005	103 836	76·00	31·11
1905	11 949	57 053	280 995	51 010	108 063	77·96	35·90
1906	11 804	55 603	295 808	53 070	108 673	85·67	36·97
1907	11 659	56 811	303 029	53 173	109 984	92 32	38·40
1908	11 303	58 575	295 392	51 951	110 526	92·78	40·97
1909	11 261	61 362	289 205	52 484	113 846	81·55	40·82
1910	11 435	63 485	302 157	53 793	117 278	78·78	40·99
Increase % fr. 1899 to 1910	10·33 %	49·91 %	17·33 %	25.03 %	37·37 %	6.17 %	61·82 %

[1] In consequence of the re-arrangement of the Swedish official statistics, later figures than those given are not available. It should be noted that builders and master-masons are reckoned among handicraftsmen.

When, a few years ago, machinery gained the upper hand in the industrial world, and one industry after the other was either transformed into a great manufacturing pursuit, or else was pushed to the wall, it probably appeared to people at that time as if the golden days of handicrafts were past. In any case, this opinion became to deeply rooted that, in spite of everything, it still remains.

It can be shown, however, that handicraft-industries have held their own very well indeed in the war of competition; they have even held their own so well that, as a rule, they can point to far greater development than that reached by factory-industries.

The great national-economic importance of handicrafts can nowadays be plainly seen, and the proofs of this importance are found both in statistics and in the general industrial development of the country.

Although it must be acknowledged that our existing statistics with regard to handicrafts are in some respects rather defective, especially in respect to the trades in which it is difficult to draw a definite line between factory-work and handicraft, and also in regard to the number of the last-mentioned class of industries; still it should be possible to gain much valuable information from the statistics that are available, and attention is therefore drawn to Table 101.

These figures are deserving of attention for several reasons. For example, it is seen by the Table that the handicraft-industries during the period given have increased far more than factory industries have done, a fact that shows the inaccuracy of the statement that handicrafts in general have decreased in consequence of the competition of the factory industries experienced in the past. The figures, consequently, bear evident testimony to the great national-economic importance of the handicrafts and show the enormous importance in Swedish production of the handicrafts.

The figures showing the assessed income from handicrafts-industries do not, probably, convey quite a correct impression, partly in consequence of the error caused by certain deductions from the amount on which taxes must be paid, and also because the census-lists which, at present, form the basis of the statistics concerning the number of handicraft-establishments, make no distinction between the handicraftsmen that carry on work as indepedent masters and such as are either purely "selfsupporting", or else are in the service of master-handicraftsmen, but, in spite of this fact, are entered on the lists under a title which is misleading, since "workman" has not been added to the list of professions.

The number of handicraft-establishments which is given in the existing Swedish statistics is, consequently, clearly incorrect and greater than the actual number. It is impossible to state the exact number of independent handicraftsmen there are in Sweden, but it is probably very considerable.

The "voluntary" unions of handicraftsmen formed after the enactment

of 1864 concerning liberty of trade which are either entirely new ones or else have arisen on the basis of older "official" unions founded on the enactment of 1846 — several amongst the latter group dating back to the old guilds — had, until the year 1893, no central organization to unite the interests of all and to watch over the vital matters that were common to the handicraft-industries. In the last-mentioned year was established the "*Central Board for the Handicraft- and Industrial Associations of Sweden*", the seat of which was in Stockholm; this laid the foundation, some years after, for the "*Handicraft- and Industrial Organization of Sweden*", which, in its turn, was later reconstituted as the "*Central Organization for the Industries and Handicrafts of Sweden*". The title of the organization not being a correct one, as the union never embraced the great industries, and as its field of activity also included the protection of the economic interests of the employers, it soon became necessary once more to transform the institution, and so, in 1905, there was founded "*The Handicraft Organization of Sweden*", which, since the date mentioned, has developed exceedingly degree and, at present (1913), embraces 111 handicraft-associations, with a total of 7 500 members, besides some one or two hundred passive members, who are chiefly men belonging to the great manufacturing industries, but who are interested in the development of handicrafts.

During the 8 years of its activity the Handicraft Organization of Sweden has shown that it is suited to be a central organization for the promotion of the development of handicrafts, both as regards technical-economic interests and also as regards professional skill. In addition to the internal measures taken by the Handicraft Organization, for the purpose of awakening and supporting interest in common efforts for the general development of handicrafts — such as the organization of annual meetings, the publication of the Swedish Handicraft Journal, the Swedish Handicraft Calendar etc., — the Organization has taken the initiative for several measures for the attainment of increased professional training; it has brought forward proposals, amongst other things, for the drafting of an Apprentice Bill; it has made an investigation with regard to the establishment of practical trade schools, the obtaining of State-bursaries for technical teachers and the directors of technical evening-schools and other similar educational establishments; it has endeavoured to obtain an increased State grant for travelling bursaries for handicraftsmen and their workmen, and for the creation of a State loan-fund for handicrafts and the smaller industries. In regard to this last-named measure the Organization has also been intrusted by the Government with the task of being the channel for the application for and grant of loans. The Organization has also brought into existence funds, the interest of which is devoted to the support of the various items of the above programme. These funds at present amount to a little more than 50 000 kronor.

Among the internal measures may be mentioned that the Organization has drawn up a general journeyman-diploma and apprenticeship-certificate, and that it awards prize-medals, these latter bearing the portrait of the patron of the Organization, King Gustavus V, together with the motto of the Organization "Till yrkenas förkovran" (For the promotion of handicrafts).

During the last few years the Organization has enjoyed a State grant, partly for the publication of its journal and also in consideration of its position as the channel for the State loans, granted for the procuring of machinery, motors, etc. for handicraftsmen and smaller enterprises.

The Organization has had its headquarters in Kristianstad since 1905.

Prize Medal of the Handicraft Organization of Sweden.

Domestic Industries.

German political economists, such as Schmoller and Bücher, usually define domestic industry, in its original form (Hausfleiss), as that form of production which is carried on in the home in order to supply domestic needs, and for which the producer himself obtains his raw material direct from nature. Although not belonging to any certain period of the development of culture, this *home industry for domestic needs,* in Sweden, as elsewhere, was for a long period the chief form of industrial production; this may be called the period of domestic economy. From domestic industry for supplying home needs there have at a later period been developed *domestic industries for the purpose of sale,* where the producer, in addition to the articles made to supply his own needs, also manufactured others for purposes of exchange or to be sold for money.

That the pursuer of a domestic industry, in carrying on his work for the purpose of gain, or for home-use, obtains by exchange or purchase the necessary raw material can hardly be said to alter the character of the article produced as being one made by domestic industry; the determining factor in this case, on the other hand, should, we think, be the absence of any assistant, specially engaged and paid for the purpose of carrying on the work. Other distinctive features of domestic industry in the real

sense of the word are, that it rarely occupies the whole time of the worker, but is rather carried on as a subsidiary employment, usually side by side with agriculture, and also that, in general, it is based on inherited designs and models characteristic of the district in which it is carried on.

It is clear that, in our own days, domestic industry no longer forms an essential proportion of the productions of the land as a whole. The rise of the towns and of handicrafts, and, above all, the improved communications of later times, modern industrialism, together with the taste for change and alterations in domestic utensils, clothing, etc., which the former phenomena, in their turn, called forth among the agricultural population, too, and which is not so easily satisfied by home industries, are factors that, in most places in Europe, have more or less completely exterminated domestic industries, unless they have degenerated into house-industries or "sweating", with an unscrupulous exploitation on the part of capitalist middle-men.

Among the few countries where domestic industries have succeeded in retaining their position to any great extent, Sweden is, beyond possibility of contradiction, one of the principal. The reason of this is partly the fact that from ancient times the Swedish nation, with its love of work and sense of beauty, has been able to produce designs and models of rare beauty and originality, especially as regards textiles and carpentry-sloyd, and that it has since, with unswerving conservatism and devotion, held fast to the work and methods of work handed down from ancestral times. But the chief reason why domestic industries have survived in Sweden is, we think, to be found in the position and natural features of the country. In thinly populated districts, where the communications are but little developed, it is greatly to the economic advantage of the rural population, even to-day, to supply their own needs, as far as certain branches of production are concerned, and in tracts where the soil is not very fertile, or where the climate is less suitable for agriculture, domestic industries carried on for profit form a by no means contemptible minor source of income. When, during four to seven months of the year, cold and the short daylight prevent any very great amount of agricultural work being done, during the afternoons at least, domestic industries, especially if there be no forest-work or other suitable winter occupations to be had, give a welcome addition to the limited income derived from work, and prevent many a one from idling his time away. The great economic and ethical importance for Sweden of domestic industries has, too, of late years, although as yet still insufficiently, in an ever-increasing degree awakened the attention of the authorities and private individuals, this attention finding expression in the adoption of various measures for the encouragement and promotion of home-sloyd.

Domestic industry for domestic supply. It is in the very nature of things that it is within the domestic industries that are carried on to supply domestic needs, rather than in similar industries carried on for the sake of profit,

that the so-called *peasant-art* is to be met with. In the case of domestic industries for domestic supply the workman, of course, feels the greatest imaginable interest for the article he makes, an interest which lasts for a far longer time than that needed for the production of the article in question, and which does not cease before the object thus produced is altogether worn out. A successful piece of work the producer honours with its daily use while, for an unsuccessful article, he would every day be put to shame in the presence of relatives, companions, and friends. The workman, therefore, not only exercises all his technical ability, but he also embodies in the work of his hands his artistic skill and his sense of beauty and harmony.

Productions of this interest, of this artistic sense, are seen, amongst other things, in the rich Dalecarlian domestic industry, with its original lace-designs, many-coloured textiles, quaintly painted wall-hangings and cupboards, its well-designed chairs with other articles of domestic use, and implements. We trace the same interest, the same artistic spirit, in the large chests of the rich Skåne peasant, filled, as they are, with gaily-coloured woven treasures with their quaint untranslatable names — "rödlakan, krabbasnår, dukagång, munkabälte, opphämta, rosengång", with the rest of all these many kinds of artistic textile productions, which, as a matter of fact, were once in general use almost everywhere in the country but, above all — besides Skåne — in Västergötland, Bohus-län, Blekinge, Småland, Dalarne, Hälsingland, and Ångermanland. Bobbin-lace-work, too, in the districts around the towns of Motala, Vadstena, and Skänninge, and in many places in Dalarne and Skåne, show us traces of this peasant-art; so does the art-knitting of Halland and the various forms of Laplanders' sloyd in leather, bone, wood, and horn. It has been asserted that this artistic peasant industry hardly exists in our own times, but the incorrectness of this assertion is plainly shown by the investigation now being carried out by the Domestic Industries Committee, appointed by the Government during 1912. It is true that this art-sloyd has fallen off tremendously, but the fact is that, even at the present day, it is carried on especially in Skåne, Dalarne, and Norrland, and that in many places, in consequence of the encouragement it has received from Agricultural Societies and Societies for the Promotion of Domestic Industries, it has increased somewhat during the last few years and, in not a few instances, has become a fairly lucrative market-sloyd.

The same investigation shows that domestic industries to supply domestic needs for *practical use alone* still play a fairly essential part in the life of the Swedish peasant. Agricultural Societies and Societies for the Promotion of Domestic Industries in most of the läns report that spinning for domestic needs is carried on in a number of farmers' families, and that weaving is practised in still more. This is especially the case in the more remote districts of the country, which are less affected by modern "culture", such as those in the Läns of Norrbotten and Västerbotten, where, even at the present day, homespun and other articles of attire required by the family, such as linen and stockings, are made at home. The same state of things exists in districts where, as in the parishes round lake Siljan in Dalarne, the ancient peasant dresses are still worn. In more centrally situated tracts, on the other hand, especially in the neighbourhood of the larger towns, the peasants prefer factory-goods to home-made articles.

The total gross value of sloyd-articles made for home needs — ordinary needle-work, repairing- and buildingwork not included — is for 1912 estimated at about 13 million kronor. Of this amount the Läns of Kopparberg, Västernorrland, Västerbotten, and Norrbotten claim 1—1½ million kronor each. It is quite natural that such figures do not by any means claim to be exact, and they are rather to be considered as fairly rough estimations, which in every case are certainly much too low.

Domestic industries carried on for profit. When domestic sloyd tends to become a means of pecuniary gain, it often loses what may be termed its artistic point. It is the purchasers' taste that is followed; it is the market-demand that, to a certain degree at least, determines the method of work and the models used; attempts are made to imitate, as far as possible, popular industrial productions, but this does not exclude the fact that this form of domestic industries has, in many places, retained its artistic spirit and its characteristic patterns, especially in places where they are pursued together with domestic industries for the supply of home needs.

Certain sloyd-centres, or centres of these domestic industries, have arisen where certain sloyd-productions are those chiefly produced; this depends on the raw materials to be had at these places, and on other external circumstances, or on the character of the inhabitants there. If such a manufacture is carried on on a large scale, it often shows a tendency to degenerate into sweated industry, where the work is carried out to order, while those employed in the work are likely to be people who have little or no private interest in the land, and who have domestic industries as their principal means of livelihood.

Spinning, during the 18th century and the first half of the 19:th, was a domestic industry carried on for the sake of profit to which the Government gave its special support for the purpose of obtaining home raw-material for the weaving-mills, then in course of establishment. At the same time that it was forbidden to carry on domestic weaving in the towns for purposes of sale, orders were given that skill in spinning should be encouraged in every possible way. Sheep-breeding stocks were established, instruction was given in the cultivation and preparation of flax, and spinning-schools were established all over the country, to which every parish was obliged to send one person to learn the work, who, on his return, was bound to spread a knowledge in his native place of the art thus learned. But as the payment offered by the factories for the yarn spun was very small, the people gradually refused to work for them and spinning gradually declined, even if home-spun woollen- and linen yarn long remained articles that the peasants themselves carried to market. In Ångermanland and Hälsingland, especially, the cultivation and spinning of flax was carried on on a large scale. The fine, silvery linen-yarn, which, ever since the middle of the 18th century, has been manufactured in the first-named province, is still unsurpassed in quality. The high quality of this production depends, to a great extent, on the suitable soil where the flax is grown and the character of the river-beds in the streams where the flax is steeped. In our own days there are only a few places, most of them in Småland, with a few here and there in the Läns of Kopparberg, Gävleborg, Västerbotten, and Norrbotten, too, where such yarn is offered at the fairs; otherwise the peasantry itself makes use of its home-spun yarn for weaving purposes. Everywhere complaints are heard of a decrease in sheep-breeding and the cultivation of flax; this is due, however, in most places, on a perfectly natural phenomenon, being the result of the birth of more thorough systems of agriculture and cattle-breeding, and of a livelier lumber-trade. The following figures may be given to illustrate the decrease in the cultivation of linen and in sheep-breeding, and, consequently, to a certain degree in that of the domestic spinning industry. While, in 1865, the yield of raw materials for spinning purposes was estimated at 37 840 quintals, in 1911, it amounted to only 5 575 quintals; during the same period the number of sheep had fallen from 1 589 875 to 945 709 head. In 1865, the area of land devoted to the cultivation of flax or hemp amounted to 0·65 % of the entire cultivated land of Sweden, while to every 1 000 inhabitants there were 386 sheep; in 1911, these figures had fallen to 0·04 % and 172.

As regards *textile productions*, it may be pointed out that, just as the cultiva-

tion and spinning of flax had their chief seat in Hälsingland and Ångermanland, so too did the weaving of linen reach its highest degree of perfection in these provinces. Hälsingland was well known for its coarse drill; the worth of the manufacture amounted in 1857 to 1/2 million kronor. In that province, the wife who did not every year provide her husband with at least 1 000 ells of linen cloth for sale was considered to be very incapable. The fine linen cloth of Ångermanland was celebrated beyond the borders of the country. As early as 1751, the four Estates of the Kingdom began to give premiums for such linen but, in spite of this encouragement, the production, which, in the middle of the 19th century was valued at 700 000 kronor, steadily decreased and is now of little importance in that province. The greater part of the Ångermanland linen went to Russia, and its sale, like that of the Hälsinge textiles, was carried out by the peasants themselves or by a special class of pedlars. Västergötland, too, especially the hundreds of Mark, Kind, Bollebygd, Ås, and Redväg, have long been the seats of the linen-weaving home-sloyd which is still carried on, on a considerable scale in the hundred of Mark, but the yarn which is employed nowadays is a factory-product and the industry has fallen into the hands of middlemen. Cotton-textiles soon took the lead, however, in these Västgöta country districts, and even to-day it is widely spread in the hundreds of Mark, Kind and Bollebygd, but it is almost exclusively an industry that exists by executing the middleman's orders. Woollen textiles, too, have been manufactured from very ancient times in these tracts, and the process of development from a domestic industry proper to a sweated industry has been the same as for the other forms of textile sloyd carried on there. A large amount of plain woollen and linen cloth, too, is manufactured and sold in the Län of Västerbotten, while the artistic textile production intended for sale has its chief seat in the Län of Kristianstad.

The value of home-woven cloth sold in 1911 is calculated at 2 1/2 million kronor.

Knitting by hand, as a home industry carried on for profit, has been most widely spread in the south part of the Län of Halland, where it is still carried on, on a small scale, to order. *Knitting by machine*, also to order, is carried on, on a large scale, in the districts round Borås.

Bobbin lace-work for purposes of sale has been carried on since the Middle Ages in the country round the towns of Vadstena, Motala, and Skänninge.

Joinery was formerly carried on extensively in several places where now it has either been transformed into factory-production, or where it is still pursued as a domestic industry carried on for profit; it exists chiefly at Östervåla in Västmanland Län, Kyrkefalla in Skaraborgs Län, Lindome in Halland Län and in the hundreds of Östra and Västra Göinge in Kristianstad Län. The furniture is, as a rule, sold to middlemen, who sell it either in their own shops or at fairs.

Casks are chiefly manufactured in the Läns of Kopparberg, Västmanland, Örebro, Halland and Kristianstad.

The carpentry-sloyd carried on for the purpose of sale is mostly carried on in Småland, Västergötland, Halland, and Västerbotten.

The gross value of carpentry-sloyd articles sold in 1911 is estimated at 3 1 2—4 million kronor.

Basket-making is of several kinds. Coarse, so-called coal-baskets, for the use of the railways, are manufactured mostly in Älvsborg Län, south of Alingsås, and in the Läns of Kopparberg, Blekinge, and Kristianstad while baskets made of chip are made in the Läns of Kopparberg, Kronoberg, and Kristianstad. Fine wicker-work baskets are made purely as a domestic industry carried on for profit; it exists on a large scale in the north-east of Blekinge, and it is here, too,

that the most flexible and beautiful forms of all kinds of baskets are found, even among the coarsest qualities.

"*Small sloyd*" (whisks, brooms, wooden spoons, etc.) are manufactured on a very large scale in the south of Älvsborg Län, especially in the hundred of Bollebygd, and also in the hundred of Östra Göinge in Kristianstad Län.

The production of toys as a domestic industry carried on for profit is an unimportant one, and the only place where it is pretty generally carried on is the parish of Oderljunga in Kristianstads Län.

Pottery manufacture as a domestic industry in connection with small, independent farming, was formerly carried on in the south of Halland, and is still found in the hundred of Åsbo in Kristianstad Län.

Wrought-Iron manufacture (nails, tacks, horse-shoes, knives, scissors, etc.) was formerly carried on in the parish of Lerbäck in Örebro Län and in the parish of Godegård in Östergötland Län, but nowadays it is rarely found. Scythes are still made in the Läns of Kristianstad and Kronoberg; locksmith's work and girdler's work are carried on in the parish of Loshult in Kristianstad Län and in Hallaryd parish in Kronoberg Län. Stirrups and other fine smith's-work for horse trappings were, until some ten years ago, supplied to the army from these places. Their sale is, for the most part, now carried on by means of shopkeepers living in the neighbourhood.

The *hand-manufacture of wire-netting* and *bolting cloth* is still carried on in the parish of Gnosjö in Jönköping Län, but the once widely-spread domestic industry carried on for profit, in the shape of the manufacture of hair-pins, hooks-and-eyes and purses, etc., is nowadays pursued only by a few elderly persons.

The *manufacture of fishing-tackle* is carried on everywhere in the neighbourhood of the coasts.

The *making of shoes and boots* as a domestic industry, pure and simple, was once of great importance in the whole of Örebro Län, especially in the parish of Kumla, but now it has been more and more transformed into factory-work or a sweated trade. — Lappland-shoes and skis for sale are made in the northernmost läns; this holds good also of skins, horn- and bone-work. The parish of Malung in Kopparberg Län is the seat of a *leather-sloyd* carried on on a large scale.

In addition to these "sloyd-centres", domestic industries for sale are still carried on by persons who work to order or who themselves sell their productions at fairs and on market-days. Over the whole of Sweden there are women-weavers, basket-makers, carpenters and makers of small-sloyd who, as a rule, carry on their domestic industry as a by-occupation in addition to their agricultural pursuits. But, as a rule, they do not themselves know very exactly how much they sell every year and, as they know still less how much they earn by means of their domestic industries, the figures in this respect must always be treated with a certain amount of caution. The distinction, especially, between a real domestic industry on the one hand, and a handicraft and sweated industry, on the other, is often a very fine one.

According to the investigation in 1911 by the Domestic Industries Committee, the number of persons occupied in domestic industries pursued for profit amounted to about 49 000, and the value of the articles sold to 16 million kronor, one half of which comes from real domestic industry and the other from similar work of sweated industry and handicraft. The total wages are calculated at 7 1/2 million kronor about 5 millions of which can be assigned to real sloyd and only 2 1/2 million kronor to sweated industry and handicraft. Domestic industry for the purpose of profit is most spread in the southern part of Älvsborg Län, with an annual production of 5 million kronor, the greater

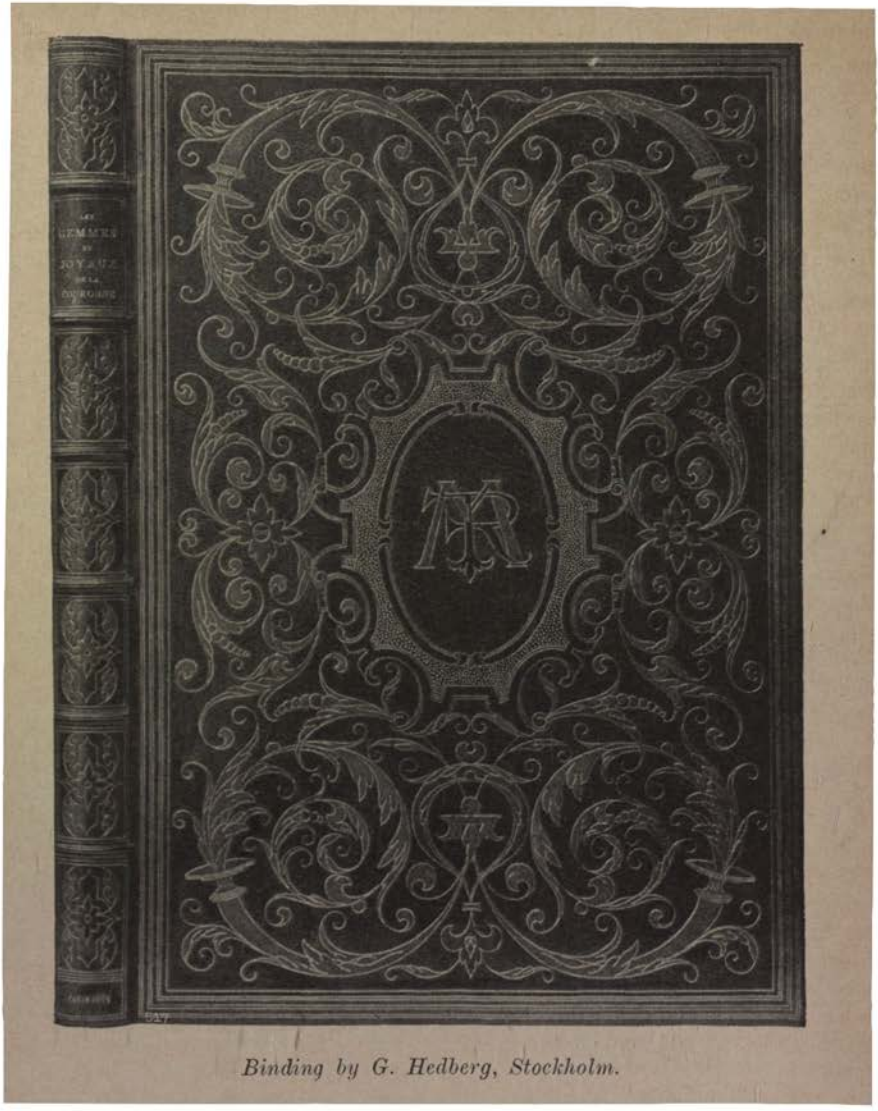
part of which, however, is derived from sweated industry. Other districts where domestic industries for the purposes of profit are of importance are the Läns of Kopparberg, 1 289 000 kronor, Västerbotten, 1 288 000 kronor, and the Läns of Jönköping, Kristianstad and Halland, each of which has a production-value of 600 000—800 000 kronor.

The domestic industries movement. It is certain that the production of home-industry articles, especially those made with a view to sale, has, after a long period of decline, considerably increased during late years, and this, thanks to the modern home-sloyd movement, which has as its object the re-awakening of the old national love of work, the development of manual skill and the creation, on the basis of inherited traditions, of a revivified home-sloyd as a source of income for the great mass of the people. The movement may be said to date from the foundation of the Northern Museum. By the efforts of the society called "Handarbetets vänner" (The Friends of Art Needle-work), Jacob and Thora Kulle, and others, many beautiful textile designs and ancient technics have been preserved from falling into oblivion, and the artistic productions of domestic industries turned into articles of trade, chiefly by the efforts of the Association for Swedish Domestic Industries (Sw. Föreningen för Svensk Hemslöjd). The Agricultural Societies, which, ever since their establishment, have had the improvement of domestic industries as one item of their programme, began to work most zealously in the above-mentioned direction, aided, as they were, by increased State grants. By means of co-operation between the Agricultural Societies, the Domestic Industries Associations (which, at the present day, exist in most of the läns), and private persons, there have been established within the districts of the various Agricultural Societies fixed schools of domestic industries, and ambulatory sloyd-courses, where the peasants are instructed in domestic industrial pursuits, especially in those peculiar to the province, either gratis or for a very low fee; old designs have been imitated, new ones drawn which were based on the old ones, and steps have been taken to provide for the sale of the objects produced by these domestic industries, by the establishment of special shops for this purpose. But much remains to be done ere domestic industries once more occupy the place they deserve — not in rivalry with great manufacturing industries and handicrafts, but side by side with, and supplementing these forms of production, and as a weighty ethical, esthetical and economic factor in the life of the nation.

13. INDUSTRIAL ART.

The flourishing condition of the industrial art of Sweden took its rise more than forty years ago and has steadily developed ever since. The first inspiring impulse in this branch of industry, after nearly half a century of extreme decadence, came from England, where the Great Exhibition of 1851 showed this decline in most discouraging aspect. The reaction which then commenced, stimulated by artists and others interested in art, found its first and momentous expression in the establishment of the South Kensington Museum and the industrial art schools associated with it. From England the movement extended to other coun-

tries, and industrial art museums and establishments for instruction in industrial art were founded everywhere.



Binding by G. Hedberg, Stockholm.

In Sweden, the movement found expression in a form which very essentially differs from those of other countries, the result being that Swedish industrial art, in one branch especially, attained to a most flourishing and notable degree of development, at an earlier date than that of other countries.

This special branch consisted of women's textile handicrafts — art-weaving, and art-needlework — those which, in Sweden, first became the

objects of a reformation in an artistic direction. The society called "*Handarbetets vänner*" (the Friends of Art Needle-work), founded in 1874, by *Sofia Adlersparre, Hanna Winge,* and *Molly Rothlieb,* made it its chief aim to raise Swedish **textile art** to a higher plane, in an artistic and patriotic direction. It was, in the first place, the rich treasures of peasant textiles, those of Skåne especially, that formed the basis of their studies for purposes of imitation and development. In the task of collecting these ancient textiles, the Society obtained valuable, expert assistance from *Jakob Kulle,* an artist warmly interested in the work. It was, too, about this time that *Artur Hazelius* formed his fine collections of peasant textiles.

From the very beginning, when the work of the Society was chiefly devoted to the preservation and development of the ancient peasant designs, the movement has been one of constant development. At a very early period of the Society's existence, some Swedish artists began to compose designs for the Society, at first in connection with the historical styles, but, by degrees, their compositions became more independent and individual and this feature, since the beginning of the present century at least, has been distinctive of the textile- as well as of other forms of Swedish industrial art. Sweden now possesses a large number of clever and artistic women-designers for textile work, as in the very nature of things, it has chiefly been women that have devoted themselves to this branch of work. Among the principal of these may be mentioned: *Sofia Gisberg, Selma Giöbel, Agnes Branting, Karin Wästberg, Maria Adelborg, Maja Sjöström, Annie Frykholm, Agnes Sutthoff,* etc. Among the artists, chiefly painters, who have also devoted themselves to textile composition, the principal have been: *Alf Wallander* (†), *Carl Larsson, Gunnar Wennerberg* (†), *Gunnar Hallström Gustaf Fjæstad.* All these and many others have worked both for the Friends of Art-Needle-work and for the other associations with similar aims that have arisen at a later date. The oldest of these last-named societies is *A. B. Svensk Konstslöjdutställning, S. Giöbel,* (Swedish Art Industry Company, Ltd.), established and, for a number of years, directed by *Selma Giöbel* — who, at present, is the directress of an enterprise of a similar character at Vadstena — and which later on came into the hands of a Company whose artistic director was the painter *Alf Wallander;* the Company has since extended its field of activity to the manufacture of artistically designed furniture. The large *A. B. Nordiska Kompaniet* (Northern Company, Ltd.) also embraces a department for textile art, directed by *Thyra Grafström.* The *Atelier Licium,* which has made a speciality of ecclesiastical textile art, has been started by *Agnes Branting,* who is also the textile leader of the society called *Pietas,* whose field of work is the restoration of ancient textile fabrics.

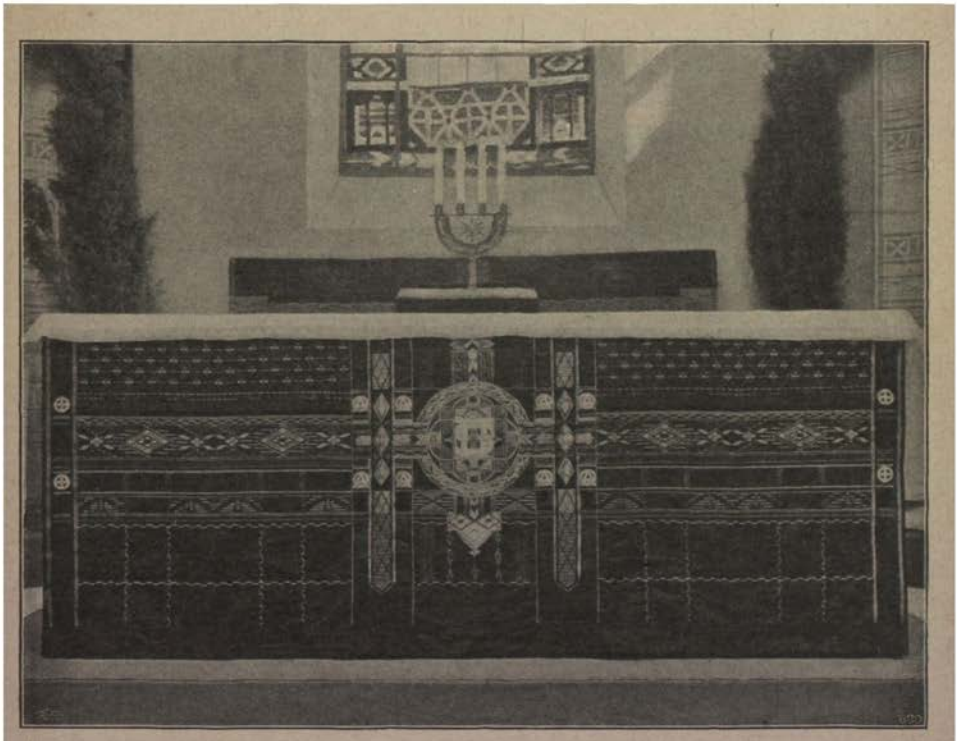
A special branch of textile art, the *making of lace,* has, of late years, been the object of great and special interest. The ancient Swedish bobbin-work, which seemed to be on the point of entire extinction, has been revivified by societies and private persons, and interest in its beautiful, national designs has spread to all classes of society. In the three chief centres where this art has been carried on since ancient times, viz, Skåne, Dalarne, and the town of Vadstena in Östergötland, schools and courses of instruction have been established. In Skåne, *Augustine Ehrensvärd,* in Dalarne chiefly *Ottilia Adelborg,* and, at Vadstena, *Ingeborg Petrelli* have devoted themselves to the revival of this beautiful form of lace-making. The initiative to the development of higher-class and more artistic needlework-lace has been taken by *Hilda Starck-Lilienberg,* who devotes

Interior with furniture, etc. by Ferd. Boberg. Tapestry by Anna Boberg.
(Swedish Industrial Art Exhibition, Stockholm 1909.)

her talents, both as a teacher of the work and also as a practical artist, to the promotion of this form of lace-making.

It was, consequently, specially women's needlework that in Sweden first became the object of artistic attention and development, and this at

an earlier date than in any other country, and we find here the reason why Swedish textile-art now stands absolutely foremost and without a competitor. As regards the other branches of Swedish industrial art, many years passed before they experienced a similar revival for, as a matter of fact, it was under the influence of the great artistic reformation which, originating in England, commenced its triumphal march through the whole of the civilized world, towards the end of last century, that Swedish industrial art was first given a really artistic direction.



Antependium by The Friends of Art Needle-work.
Cathedral of Lund.

Swedish **cabinet-making** has long been known for its good, sound work. As regards the designs employed, the system of copying, or applying, ancient, historical patterns, which was a distinctive feature of the latter part of the 19th century has, under the influence of the artistic renaissance of our own days been succeded by free, individual creations. In Sweden, as in other countries, it has been artists and in the first place, architects that have headed this new movement. *Ragnar Östberg, Carl Westman, Axel Lindegren, Lars Wahlman, and Elis Benckert* (lately deceased), all of whom possess original and personal talents, are some of the principal names that should be mentioned in this connection. A special place is occupied

by *Ferdinand Boberg,* whose gifted hand in this branch, as in all other departments, of industrial work, produces elegant compositions of unmistakeably original individuality. The painter *Alf Wallander* has already been mentioned as a cabinet-making artist in connection with his textile work. It should be especially pointed out that the demand for modern, independent forms has given rise to a great number of prominent specialists in this branch of industrial art — real "furniture-architects", who devote themselves exclusively to designing furniture. Among the foremost of these may be mentioned *David Blomberg, Ragnar Östman, Isidor Hörlin, A. Nordenborg,* and *A. Elisson.* All these architects and furniture-architects work for the most part for the large "furniture-firms" in Stockholm and in some provincial towns, which carry on furniture-manufacture on a large scale, such as the *Nordiska Kompaniet, Myrstedt & Stern, Karl Johansson, etc.,* of Stockholm, *Selander & Söner,* of Gothenburg, *Axel Beckman,* of Norrköping, etc. They also work for the many skilful cabinet-makers who carry on their trade as a handicraft.

Swedish **ceramic manufacture,** which has its principal representatives in the two great china-factories of *Rörstrand* (founded 1727) and *Gustavsberg* (founded 1827), has, in our own days, attained a hitherto unapproached degree of development. Rörstrand, with its feldspar porcelain and its "under-glaze painting", has produced decorative objects, table-services, etc., of great artistic merit, composed, for the most part, by *Alf Wallander,* aided by a staff of other excellent and well-schooled artists. Gustavsberg received a powerful artistic impulse under the direction of the painter *Gunnar Wennerberg,* whose faince-works in sgraffiati-decoration and crockery-ware with barbotine-colouring — the latter work continued in a specially successful manner by *Beata Mårtensson,* even after both these artists had left the factory — form the finest production of the works, from an artistic point of view.

During the last few years, too, the manufacture of **earthenware** of artistic design and execution has sprung up in different parts of the country. The chief producer among these artistic potters is *Tage Zickerman,* Wittsjö, with his admirable designs and shapes and his varying glazings. Among other producers of such pottery, may be mentioned *Hilma Persson,* Arvika, *Anders* and *Bess Wissler,* Mariefred, and the *Uppsala-Ekeby Aktiebolag,* Uppsala, while the old *Höganäs Works,* with sometimes very successful results, have also turned their attention to the artistic side of earthenware-manufacture.

Artistic **glass-manufacture** is carried on chiefly by the two large glass-factories of *Kosta* and *Rejmyre.* Specially deserving of mention are the beautiful decorative objects in sculptured- or cameo-glass, for which, at first, *Gunnar Wennerberg* designed the models, this artist being succeeded by *Alf Wallander,* who has also made designs for the crystal-glass ware.

Goldsmiths' art is carried on by only few firms, but these carry on the

work on a very large scale. In addition to the large *Guldsmedsaktiebolaget,* of Stockholm, which supplies all the goldsmiths and silversmiths of the country with goods, the three firms, *C. G. Hallberg, K. Andersson,* and *Gust. Möllenborg* have large workshops in Stockholm, the first two with branches in provincial towns. Among the more prominent artists who have worked for these firms, may be mentioned *Ferd. Boberg,* — who in this branch of art has produced perhaps his most exquisite compositions — *Agi Lindegren, Vict. Andrén, Olga Lanner,* and *H. Lundstedt.*

In the treatment of the base metals for the purposes of industrial art, artistic **ironsmith's work** occupies a prominent place, and grows in popularity from day to day. *Petrus Forsberg,* Stockholm, carries on this beautiful work on a large scale. Among other excellent producers of artistic ironsmith's work may be specially mentioned *Petter på Myra,* of Arvika. **In artistic founding,** *H. Bergman* and *O. Meyer,* both of Stockholm, vie with each other in producing work of singular perfection. During the last few years, a sculptor, *H. Elmquist,* has employed a method of casting invented by him, which has attracted attention for the possibilities it affords of producing delicate artistic effects.

Finally, as regards artistic bookbinding, this branch of industrial art is pursued with unrivalled elegance and taste by *Gust. Hedberg,* of Stockholm.

Nearly all the professional designers who have been mentioned above, as working in the various forms of industrial art, have been trained in the higher industrial-art division of the **Technical School,** Stockholm. This institution, which is a most excellent one of its kind, and whose principals (*V. Adler* was succeeded by *Th. Thorén* in 1910) unremittingly endeavour to conduct the instruction on modern lines, possesses a staff of excellent teachers and is attended by a very considerable number of pupils. The other technical schools of the country, of which those at Gothenburg and Malmö are the principal, are under the inspection of the Director of the Technical School of Stockholm.

The Technical School of Stockholm was founded in the middle of last century by the **Svenska Slöjdföreningen** — the Swedish Sloyd (Industrial Art) Association —, which in many ways, has contributed to the progress made by the industrial art of Sweden.

Founded as early as the forties and recruited from those employed in industrial art and from other interested circles, the Society has arranged prize-competitions and lotteries for artistic objects; technical lectures and exhibitions of older and newer productions of industrial art have been held at its meetings, and it has also issued handbooks, designs, and returns (Sw. meddelanden). Since 1905, this publication has been entitled the "Svenska Slöjdföreningens Tidskrift" (The Swedish Industrial Art Association's Journal). Among the more important measures and undertakings of the Society, may be mentioned, in addition to the establishment of the Technical School of Stockholm, the presentation to the State in 1884 of the

Industrial Art Museum belonging to the Society; the arrangement of the Gustavian Exhibition, 1891, the Metal Exhibition, 1895, the Charles XIV John Exhibition, 1900, the General Swedish Exhibition of Industrial Art in Stockholm, 1909, and, now recently, of the Swedish Industrial Art Association's great Swedish Industrial Art Lottery, 1911—13.

14. THE MOST PROMINENT SWEDISH INVENTORS IN THE DOMAIN OF INDUSTRY.

We shall close this chapter with an enumeration of some of the most prominent of the great number of Swedish inventors in the domain of industry, and of the most important of their inventions.

G. A. Betulander (b. 1872). Important inventions for automatic telephone-exchange apparatus.

J. A. Brinell (b. 1849). Important improvements in the technics of testing materials.

O. E. Carlsund (1809—84). Prominent constructor and inventor in the steam-engine industry and in ship-building.

J. A. Dahlgren (1810—70). Constructor of cannons of large calibre, called "Dahlgren cannon".

G. Dalén (b. 1869). Inventor of the automatic regulator and other devices for lighthouses, floating lights, and railway-signals (sun-valve, Aga-light). Was awarded the Nobel-prize for physics in 1912.

C. E. Egnér (1868—1914). Important improvements in telephone-technics in general, especially in long distance telephony.

C. D. Ekman (1845—1904). Inventor of the sulphite-method, of great importance in the manufacture of cellulose.

G. Ekman (1804—76). Introduced important improvements in the Swedish iron-industry.

John Ericsson (1803—89). Discovered the practical solution of the screw-propeller problem; inventor of the steam fire-engine, the monitor, the hot-air-engine, etc.

L. M. Ericsson (b. 1846). Important improvements in the telephone and its accessories.

O. Fahnehjelm (1846—1911). Inventor of the magnesia-comb for incandescent lights (a fundamental principle for modern incandescent lighting).

J. G. Gröndal (b. 1859). Important inventions connected with the briquetting of iron-ore and briquetting-furnaces, etc. in the metallurgical branch. Hon. D. Ph.

G. F. Göransson (1819—1900). Effected improvements in the Bessemer-process, which first rendered this method of practical use.

J. G. Holmström (b. 1874). Important improvements in telephone-technics and especially in long distance telephoning.

C. A. Hult (b. 1867) and *O. W. Hult* (b. 1863). Inventors of an extremely ingenious friction-gearing mechanism ("centratorväxeln"), a rotary steam-engine, etc.

E. V. Jungner (b. 1869). Important improvement in the electric accumulator, etc.

F. A. Kjellin (1872—1910). Important improvements in electric furnaces for the production of iron and steel. Hon. D. Ph.

P. Lagerhjelm (1787—1856). Constructor of a machine for testing the tensile strength of iron and steel, thereby becoming the founder of the mechanical testing of materials.

A. Lagerman (1836—1904). Important inventions in the match industry; type-setting machine (typotheter).

G. de Laval (1845—1913). A great number of important inventions in the dairying industry, such as the separator, the lactocrite, the emulsor; and in steam-turbines, etc.

B. Ljungström (b. 1872). Inventor of the "Svea-bicycle" with changeable gearing and vertical treadling, and also of important improvements in steam-turbines, etc.

F. Lundgren (b. 1854). Prominent inventor of machinery in the match-industry.

J. E. Lundström (1815—88). Important improvements in the manufacture of safety matches.

A. Nobel (1833—96). Inventor of dynamite and smokeless gunpowder (Nobel-gunpowder).

I. Nobel (1801—72). Introduced nitro-glycerine as an explosive (Nobel-blasting oil); inventor of the first submarine-mine.

C. R. Nyberg (b. 1853). Inventor of ingenious apparatus for producing a high temperature by direct and smokeless combustion of petroleum (soldering-lamp, etc.)

C. G. von Otter (1827—1900). Inventor of lighthouses with intermittent signals.

H. Palmcrantz (1842—80). Constructor of the machine-gun, afterwards improved by Maxim and Nordenfeldt, the latter also a Swede.

G. E. Pasch (1788—1862). Inventor of the safety-match.

Kr. Polhem (1661—1751). A great number of ingenious inventions in the mining industry.

S. Rinman (1720—92). Various important inventions in the same industry.

E. G. N. Salenius (b. 1862). Inventor of the radiator for making butter from milk.

A. Stille (1814—93). Improved surgical instruments and appliances.

R. V. Strehlenert (b 1863). Important improvments in apparatus and chemical methods for the production of artificial silk.

J. G. Swartz (1819—85). Inventor of the so-called ice-method in dairy-farming.

A. G. Theorell (1834—75). Constructor of a meteorograph, registering and printing automatically in ordinary type the indications of the barometer, of the dry and wet thermometers, of the anemometer and the anemoscope.

A. Welin (b. 1862). Inventor of an improved breech-loading mechanism for ordnance and of important improvements in boat-davits.

J. Wenström (1855—93). One of the founders of the three-phase system (of great importance for transmission of electric power).

E. V. Westman (1823—91). Constructor of a roasting-furnace of great importance in the iron industry.

M. Wiberg (1826—1905). Machine for automatically calculating and printing logarithms.

J. G. Wiborgh (1839—1903). Metallurgical inventions; Wiborgh-phosphate.

J. G. V. Zander (b. 1835). Founder of medical-mechanical gymnastics, and constructor of the accessory apparatus and appliances.

John Ericsson's Mausoleum at Filipstad.

VIII.

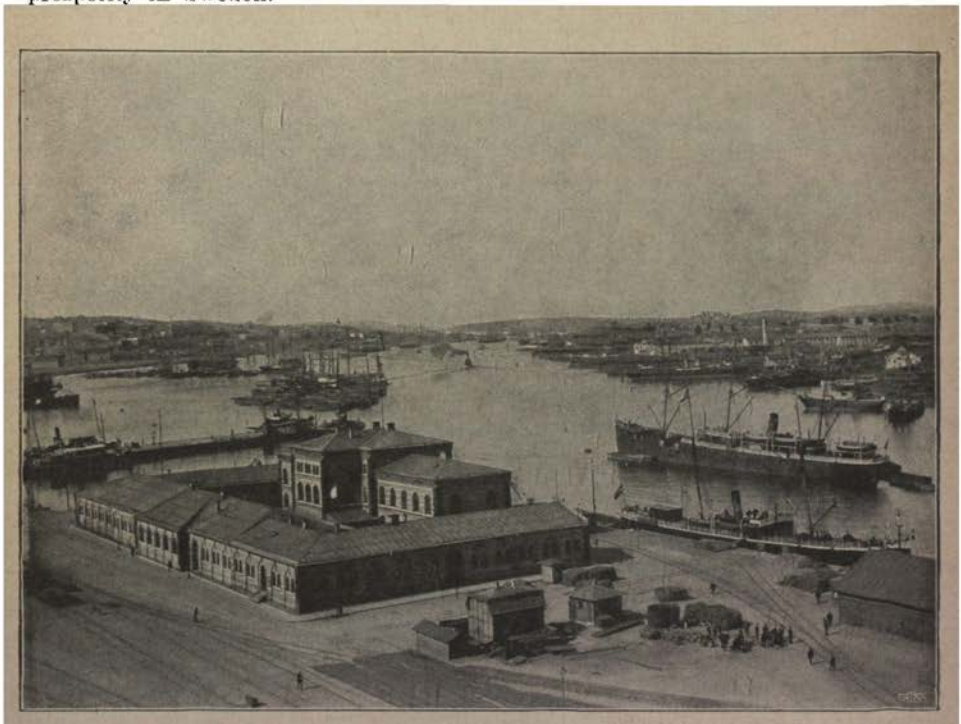
COMMERCE.

Historical.

Swedish *foreign trade* has had great difficulties to contend with. Only in proportion as new impulses in productive labour have rendered more abundant those of the country's own products available for the purpose of foreign trade, and as the development of political conditions and of internal communications have lessened the gap between Sweden and the foremost civilized countries, have better conditions been shaped for a brisker exchange with foreign countries.

During the Middle Ages, the commerce of Sweden had reached only an insignificant stage of development — with one brilliant exception: **Visby.** Even at the time of the introduction of Christianity, Gottland enjoyed a brisk commercial activity, which developed more and more, when it became the centre-point of the commercial communications between Northern, Western, and Eastern Europe, right away to the Orient. The importance of this island was rendered possible by its convenient position in respect to the communications of that time. Later on, the commerce of Gottland was concentrated in Visby, which advanced to importance during the twelfth century, and was organized under German auspices. During several centuries, Visby was a wealthy and powerful republic, whose importance as regards shipping matters of the time can be estimated from the fact that Visby maritime law was taken as a standard even in foreign countries. To the advanced culture which flourished on the island under the shelter of wealth witness is borne by the magnificient architectural memorials which are still preserved on Gottland. The zenith of Visby's greatness was reached during the 13th century, but the town was still flourishing even later. Her decline may be ascribed to the new commercial higways which the Crusades opened up, and further to the rise of Lübeck; but, above all, to the exclusion of European culture and commerce from Russia, owing to her conquest by the Mongols — an event of the most fatal importance for Sweden, for, by it, was totally obstructed the civilizing influence that had gone out from Sweden over the whole of eastern Europe, and the barbarism of the far East was brought into our immediate neighbourhood. As regards Visby, in 1361 it became a victim of the Danish king Valdemar Atterdag's predatory raids, and after the lapse of another century the town's ancient grandeur had vanished.

Within Sweden herself, during the Middle Ages, commerce was chiefly in the hands of the Germans. As there was no real export from Sweden, foreigners came here to get rid of their own wares. **Stockholm,** which was the only trading town in the country worthy of mention, besides Visby, was long under German control. The treaty that was concluded between Lübeck and Sweden was extremely profitable to the powerful republic, and for nearly three hundred years our trade was under the control of the **Hanseatic League.** *Gustavus Vasa* was the first to burst these fetters, which prevented every possibility of fuller prosperity in Sweden.



The Harbour of Gothenburg.

When Gustavus Vasa assumed watch and ward over the Swedish people, the Swedish trade was *strictly limited to the Baltic;* scarcely a single Swedish vessel sailed beyond its limits. At the same time as the king worked to secure an increased trade in Swedish commodities, he directed his endeavours towards extending her shipping. At this period the Swedes began to sail to Holland, England, and France, — nay, even to Spain and Portugal. By fair means or foul, we can say, Gustavus Vasa tried, besides, to educate his Swedes as traders.

Charles XI effected the division of our towns into *staple towns* and *inland towns,* of which the former carried on the foreign trade. Among them Stockholm was to be the chief Baltic port and Gothenburg the chief port on the North Sea.

Gustavas Adolphus did extraordinary services for the improvement of Swedish trade and *Axel Oxenstierna* likewise. "The kingdom's welfare depends upon trade and shipping" was a pronouncement often heard from Gustavus Adolphus.

Side by side with growth of her political power at this time, Sweden's foreign commercial relations expanded. Interest in the development of industrialism was created, and especially Swedish iron secured a prominent position in the markets of the world. With its excellent position in the very middle of the realm which was in process of creation round the Baltic, Stockholm became an important trading town, and several great commercial houses arose there. Few periods in our history have been so characterized as this by such great endeavours to expand our trade and industries.

New methods, too, were introduced into our industrial activity, private capital began to make its appearance and to make itself felt, and from this time can be reckoned the beginnings of the *company system*, which is of such significance in our own day.

With the attitude that the state assumed towards the industries of the country at that time, however, the great companies could scarcely be established without state intervention and state assistance. Thus the so-called *companies* often got a *monopoly* in the trade in certain wares and with certain countries. In 1619, the *Copper Company* was established, which obtained the monopoly of purchasing and exporting all Swedish copper. After ten years' activity, however, it had to be dissolved. A new copper company was established in 1636 but was dissolved two years later, after which the trade in copper was unrestricted. Far more comprehensive in its operations was the so-called *Southern Company*, which obtained its privilegies in 1626, on the initiative of the Dutchman, W. Usselincx, and was formed to carry on trade with Asia, America, Africa, and Australia, thus exercising a monopoly over the shipping with the chief continents of the world. Unfavourable conditions, however, prevented the company from fully realizing its great plans. Of other trading companies we will only mention the *Tar Trading Companies*, which, from 1648 to 1715, had the exclusive right to purchase tar in Norrland and Finland for exportation.

Among the countries with which foreign trade was carried on during the seventeeth century, **Holland** occupies the first place. By the commercial treaties of 1614 and 1640, this country enjoyed greater privileges than other countries. During the latter part of the seventeenth century, Holland played practically the same rôle with respect to our trade as Lübeck had played during the fifteenth and the beginning of the sixteenth centuries. A number of Dutch merchants came to Sweden and invested a considerable amount of capital, especially in our iron industry, which was of benefit to the country; but, on the other hand, the Dutchmen tried to exploit our resources to the advantage of their own country. The Dutch frustrated the Swedish attempts at colonization, both in America and in Africa, and secretly and openly worked against the attempts of our statesmen to improve Swedish commerce. And so also did the Danes, who injured the commerce of Sweden especially by annoyances and extortions for which the Öresund Customs were used as a pretext. Through the Peace of Brömsebro in 1645, Sweden succeeded in putting an end to the last-mentioned inconvenience, inasmuch as the Öresund Customs were abolished. In the year 1720, however, after Charles XII's disastrous wars, they were re-introduced.

During *Charles XI's* reign, too, certain steps were taken to benefit Swedish trade, even though the king's policy of stripping the nobles of their wealth and influence ("reduktionspolitik") tended to hinder the accumulation of capital that, during the immediately preceding decades, had served to further the interest for industrialism. At the same time — though without any particular success — endeavours were made to attract the Russian-Dutch trade from Archangel to ports on the Baltic, and attempts were made to lead the Persian

silk trade up to Narva and Riga, which attempts, however, stranded, owing to insurmountable difficulties.

Charles XII, too, attached much importance to trade, but during the constant wars all trades were ruined.

During the so-called "Period of Liberty", the Government and the Estates devoted much attention to material development. The mercantile theories of the day were stringently applied. In order to protect home shipping, the so-called "Products Proclamation", an imitation of the English Navigation Acts, was promulgated in 1724, by which every foreign nation was forbidden to import into Sweden any products other than its own. Moreover, increased customs and other import prohibitions were established.

During the period 1731—40, Swedish trade already began to experience considerable expansion. From this time **England** replaces Holland as the greatest purchaser of the products of Sweden. Large, privileged companies still continued to be formed for more far-reaching and risky enterprises. The most important of these was the *East India Company*, which lived more than eighty years (1731—1813) and maintained a regular and profitable commercial connection between Sweden and the Far East.

The clogging fetters and the arbitrary privilegies, under cover of which many abuses were introduced, led to many inconveniences, however, and after the great crisis towards the end of the decade 1761—70 more liberal ideas began to prevail. Through Gustavus III's reform of the currency and the armed neutrality during the American War of Independence, our foreign trade entered upon a period of prosperity, and it is probable that our shipping has never been more profitable than during that period. Failures of the harvest and the Russian war of 1788—90, however, gave our trade a great set-back. Then, in the beginning of the reign of Gustavus IV Adolphus, favourable trade conditions followed, owing to the neutrality which Sweden observed during the great Napoleonic wars, but soon the country was visited by fresh crop-failures, trade dwindled on account of the insecurity of the seas, and finally the war with Napoleon paralyzed our foreign commerce and shipping, in spite of the fact that the profitable smuggling trade with England (who sent her goods here to be forwarded to the continent) produced temporary profit; Gothenburg in particular enjoyed a brief period of splendid prosperity.

During the unbroken peace that Sweden has enjoyed since 1814, our foreign trade has made great general progress. Even during the reign of *Charles XIV* it expanded noticeably, particularly through the regulation of the finances and the more extended freedom of commerce and trade which slowly worked its way through. More thorough still were the reforms in commercial legislation carried out in the reign of *Oscar I.* By means of new commercial treaties and more especially by the annulment of the Öresund Customs, concerning which an agreement was made with Denmark in 1857, Swedish foreign trade was advanced. That the progress of the communication system, as well as the increased capacity of production and consumption, was also a powerful lever is a matter of course.

Through *the commercial and maritime treaty with France* of 1865, Sweden accepted the free-trade system to a wider extent than before. In 1888 and 1892, the raising of many old customs and introduction of new ones marked a return to the old system. Subsequently the customs have been further revised in the direction of prohibition by resolutions of the Riksdags of 1910 and 1911. (An idea of the extent to which the new customs tariff differs from the old may be gained from the figures in the articles Customs and Commercial Policy.)

At present, however, the commerce of Sweden can be considered to be of considerable importance in comparison with the size of the population.

The progress within several departments of civilization and culture which has characterized the last decennium in Sweden has also made itself felt in the sphere of commerce. With constantly increasing commercial activity, modern commercial methods have gained an increasingly firm footing, and thanks to a growing spirit of combination, Swedish merchants have been able to make their influence felt even in the outer world. Insofar as political conditions have placed no hindrances in the way, the State has put into execution a number of the wishes submitted to it since a considerable time back by the representatives of the commercial world.

Amongst the measures that have thus been taken *to promote foreign trade* may be mentioned the following, some of which have been formulated by the Commerce and Shipping Committee, whose activities date from 1898—1900. By means of state-assisted *steam ship lines* to distant countries, direct trade has been considerable facilitated, and a considerable proportion of our trade has been snatched from the hands of powerful intermediaries. So, for example, nearly all our coffee is now imported direct from Brazil under the Swedish flag. Further, international traffic has been facilitated by arrangements come to with regard to *co-operation with foreign railways*. For the promotion of transit-trade, regulations have been issued providing for *refunding of customs charges* on certain favourable conditions, and for *free stores* and *free ports*. Increased state grants have been made for studentships for the study of *export- and trade-conditions*, and at the same time the State has made grants to institutions intended for the communication of *commercial intelligence* and for the spreading of information on trade questions. The *consular service* has been modernized, and the *administration*, together with *trade legislation*, has been reformed in the direction of facilitating foreign commerce.

The state now awards two kinds of travelling bursaries, with the object of promoting trade, namely "*export bursaries*", intended for young men who wish to work for the widening of the market for our articles of export, and "*travelling trade bursaries*", which are intended to facilitate practical training. For each group the State grants 20 000 kronor annually, which sum is suitably distributed among the applicants. The stipendiaries are nominated by the Government, and applications, accompanied by plans of the journeys proposed and the work to be undertaken, and by calculations as to the amounts required, have to be returned to the Board of Trade.

For information with regard to other arrangement mentioned here see below and in special articles (cf. Index), viz: for *regular steam ship lines;* for *railway co-operation;* for *refunding of customs charges, free ports*, and *free stores;* for *commercial information;* for *commercial education;* for the *consular service and administration;* for *commercial legislation.*

Administrative matters to do with trade are dealt with by the **Board of Trade,** of whose departments two deal with matters connected with commerce and shipping, namely, one with home commerce and shipping,

and another with foreign. The Board of Trade is under the Finance Department. A number of matters dealing with foreign trade are taken by the Foreign Office, whose trade department is under the direction of a Bureau Chief.

For the consideration of more important trade questions the Foreign Minister and the Finance Minister are entitled to call to their assistance the so-called *Commercial Council*, whose members, to the number of seven, are nominated by the Government from amongst practical leaders of trade, industry, and shipping.

As a medium for the leaders of industry themselves, the *Chambers of Commerce*, founded by voluntary co-operation, have by degrees assumed increasingly great importance.

No special trade courts exist in Sweden, but, on the other hand, in the hearing of certain cases in the borough courts in our three largest towns trade experts are called as members, and these are nominated by the town councils.

The Consular Service, which before 1906 was in certain respects under the control of the Board of Trade, is now, like the diplomatic corps, entirely subordinated to the Foreign Minister, and consular questions are dealt with by the Foreign Office; what has to do with its personnel, organization, etc. by the trade department of the Foreign Office. The different grades among consuls are Consul-Generals, Consuls, and Vice-Consuls, besides which, to assist in the execution of the consular business, are appointed clerks and attachés. The consuls of the different grades are either officials sent out from home (salaried consuls, consules missi), or else merchants or other suitable persons living on the spot (unpaid consuls, consules electi). The latter have the right to reimburse themselves for office expenses in connection with their duties without rendering accounts. Salaried consuls must be Swedish subjects, which is not a condition for the unpaid ones. Consul-Generals, consuls, and salaried vice-consuls are appointed and dismissed by the King, but unpaid vice-consuls and other officials by the Foreign Minister. — The duties of consuls are with faithfulness and zeal to watch over Sweden's interests, and to the best of their ability to promote the country's welfare, especially in the matter of trade, shipping, and industry. They are also, as far as lies in their power, to protect Swedish subjects, their property and rights, and to assist them with advice and help.

The Stock Exchange, as an institution, is but little developed in Sweden. Stockholm and Gothenburg possess fine Stock Exchange buildings, and several other towns posses similar premises. *Brokers* (so-called "official brokers") are accepted by the commercial and shipping boards of the respective towns, after which their nomination is issued by the magistracy. At the present time the members of the *Stockholm Stock Exchange* consists of 5 brokers, 16 banks, and 8 banking firms ("free" brokers). The stock exchange business done in 1912 amounted to 317 million kronor and in 1913 to 180 millions.

The institution of a **Clearing House** was not introduced into Sweden until 1899, since which time the Bank of Sweden has maintained premises and a personnel for a clearing house in Stockholm.[1] (The cashing of country notes,

[1] By "Clearing House" is to be understood an institution by means of which the different banks can daily arrange a mutual exchange of bills and cheques, so that payment or transfers need only be arranged for balances due between the different banks. The total of the business dealt with by the London Clearing House amounts to over a hundred milliards of kronor a year.

which to a certain degree gave rise to the Clearing House, was undertaken from 1857—1865 by the Stockholms Enskilda Bank and after the latter year chiefly by the Scandinavian Credit Company — "Skandinaviska Kreditaktiebolaget".) In the clearing operations participate at present, besides the Bank of Sweden, 13 private banks with offices in Stockholm, and these represent other banks on a system securing that all the business banks in the country are represented in the clearing operations. The operations in 1913 involved 6 milliards of kronor of which 80 per cent balanced out and 20 per cent was settled by transfers at the Bank of Sweden. (A certain amount of clearing takes place, besides, at all the branches of the Bank of Sweden, between the banks on the spot.)

The Swedish Chamber of Commerce Organization now covers nearly the whole country. The first Chamber of Commerce was founded in *Stockholm* in 1902, and subsequently Chambers of Commerce have been established at *Borås, Luleå, Gothenburg, Malmö, Jönköping, Örebro, Gävle, Visby, Karlstad, Norrköping*, and *Sundsvall*, most of them embracing several läns, or extensive districts beyond the urban areas. The Chambers of Commerce occupy themselves with trade, industry, and shipping. Their duties are chiefly to submit pronouncements and propositions to the authorities as regards industrial questions, but, by the side of this, they are active in the supply of commercial intelligence, they issue publications and act as arbitration-courts for the settlement of commercial disputes. Representatives of the Chambers of Commerce assemble yearly at a so-called Chamber of Commerce Assembly, for the purpose of considering matters of common interest. — There are, too, Swedish Chambers of Commerce in several places abroad, namely, in *London, New York*, and *Sydney*, whose object it is to promote Swedish commercial relations with the countries in which they are situated.

The General Swedish Export Association was formed in the year 1887, with the object of securing new or increased facilities for the disposal of Swedish products abroad. It is constituted more especially after the Austrian pattern. The Association works by obtaining information as to prices, credit, freightage, conditions, etc.; by arranging depots for and small exhibitions of Swedish products in important places; by distributing catalogues of suitable Swedish export-articles abroad; etc. Further, the Association publishes a paper "Swedish Export".

The Swedish Statistical Report of Trade, which dates from a considerable time back, is published by the Chamber of Commerce, partly in the form of an annual publication containing a complete report, and partly in the form of monthly reports, which only contain accounts of the imports and exports of the more important wares. In earlier times, these reports were none too complete, but with 1871 a considerable improvement began, and many reforms have been effected during the period 1891—1900, the publication of the reports having been much expedited. Further reforms are to be anticipated, especially as regards the *valuation of the goods*, which has hitherto left much to be desired in some respects. In this respect it has been suggested that the returns as to value shall be given by the importers and exporters themselves for every lot of goods (the so-called declared value). According to the Ordinance Nov. 28, 1913 such declarations shall, with certain exceptions, be made since Jan. 1, 1914. The monthly statistics, which were formerly published by the Royal Board of Customs, have, since 1913, been incorporated with a publication issued by the Board of Trade, under the name of "Commercial Returns" ("Kommersiella Meddelanden"), in which are also published the reports of Swedish consuls and other official communications having to do with foreign trade and shipping.

Total of Imports and Exports with Foreign Countries.

The value of the commercial exchange between Sweden and foreign countries (specialhandel; special trade) during the time since 1836 is shown by Table 102 below. During the period 1836—40, it amounted to 57 million kronor annually, but in 1912 it rose to 1 545 millions. The immense increase is partly to be explained by the fact that, before the middle of the 19th century, Sweden still lay, as it were, outside the system of international communications. The period between 1850 and 1870 is one of transition in this respect to the modern state of things. An enormous stride lies between the two periods 1866—70 and 1871—75; during the former, Sweden's commercial exchange amounted to 259 million kronor annually, during the latter, to 451 millions, or nearly 75 % more.

In Sweden, as in the majority of European countries to-day, trade statistics show an inferiority in the money-value of the exports in relation to that of the imports. It is, however, hardly necessary to enter into a discussion of the general principles underlying this circumstance, which show that the difference is, at least in part, only apparent.

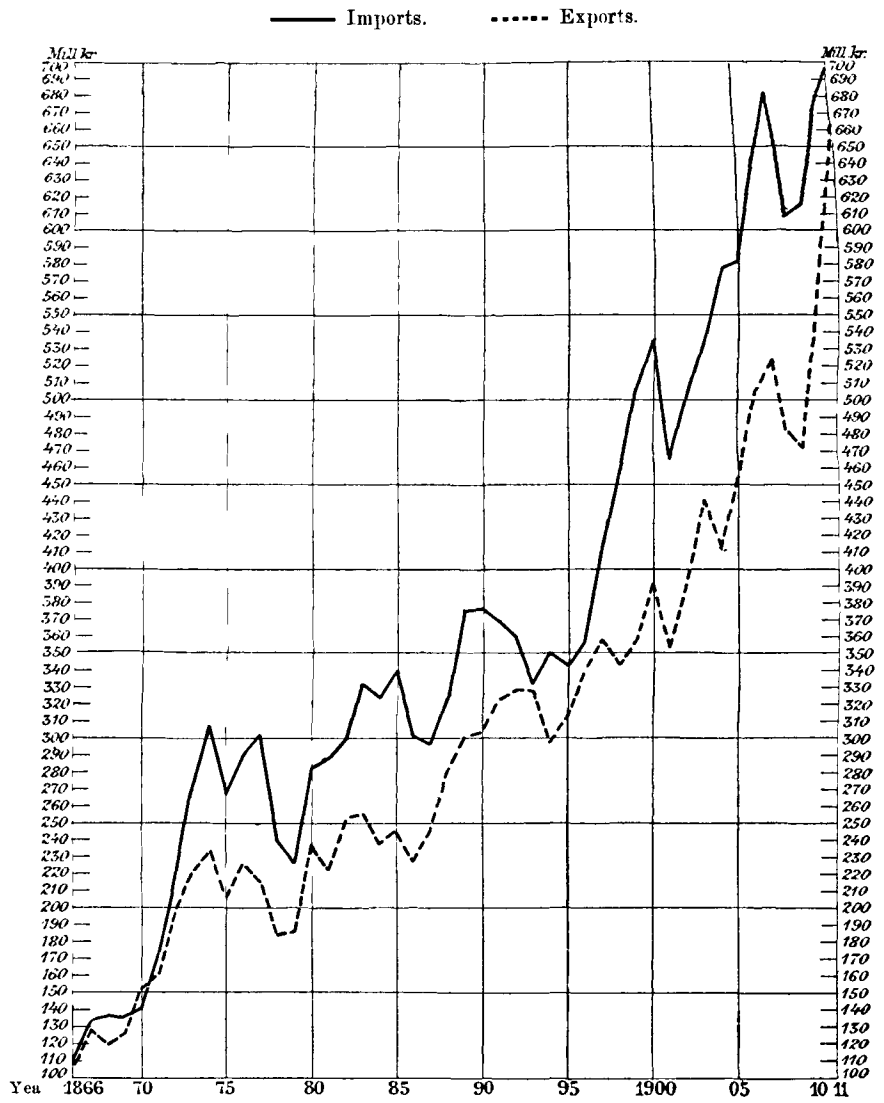
As to the very marked increase of *imports* into Sweden during the last few years, this is partly to be explained by increased consumption, but still more by an increased demand for raw materials and machinery for the very flourishing manufacturing industries.

That the value of the *exports* has, in certain cases, shown a decrease is partly explained by the fact of corrections having been made in the commercial statistics, which formerly put too high unit-values on several

TABLE 102. *Imports and Exports.*

Annually	Mean population	Value, in kronor			Kronor, per head of population		
		Imports	Exports	Total	Imports	Exports	Total
1836—40 . .	3 083 000	27 216 000	29 887 000	**57 103 000**	8·83	9·69	**18·52**
1841—45 . .	3 224 000	29 149 000	33 519 000	**62 668 000**	9·04	10·40	**19·44**
1846—50 . .	3 389 000	36 405 000	39 915 000	**76 320 000**	10·74	11·78	**22·52**
1851—55 . .	3 558 000	60 144 000	61 738 000	**121 882 000**	16·90	17·35	**34·25**
1856—60 . .	3 727 000	80 953 000	78 983 000	**159 936 000**	21·72	21·19	**42·91**
1861—65 . .	3 993 000	100 826 000	92 467 000	**193 293 000**	25·25	23·16	**48·41**
1866 70 . .	4 166 000	132 626 000	126 723 000	**259 349 000**	31·84	30·42	**62·26**
1871—75 . .	4 274 000	246 372 000	204 525 000	**450 897 000**	57·64	47·85	**105·49**
1876—80 . .	4 500 000	268 506 000	209 856 000	**478 362 000**	59·66	46·64	**106·30**
1881—85 . .	4 605 000	317 526 000	243 699 000	**561 225 000**	68·95	52·92	**121·87**
1886—90 . .	4 742 000	335 527 000	272 629 000	**608 156 000**	70·76	57·49	**128·25**
1891—95 . .	4 832 000	351 633 000	318 226 000	**669 859 000**	72·77	65·86	**138·63**
1896—00 . .	5 032 000	452 324 000	358 581 000	**810 905 000**	89·89	71·26	**161·15**
1901—05 . .	5 214 000	533 391 000	410 446 000	**943 837 000**	102·30	78·72	**181·02**
1906—10 . .	5 406 000	644 740 000	515 362 000	**1 160 102 000**	119·27	95·33	**214·60**
1909	5 453 000	616 806 000	472 980 000	**1 089 786 000**	113·11	86·74	**199·85**
1910	5 499 000	671 683 000	592 864 000	**1 264 497 000**	122·14	107·81	**229·95**
1911	5 542 000	696 617 000	663 575 000	**1 360 192 000**	125·70	119·73	**245·43**
1912	5 583 000	793 714 000	760 626 000	**1 554 340 000**	142·17	136·24	**278·41**

Value of Imports and Exports, 1866 - 1911.



of our more important export articles. The inconsiderable fall in the total value for 1909 should probably be set down as one of the effects of the great General Strike of that year.

With regard to the figures for the year 1912, it is to be noticed that the unit-values on which the statistics are based for that year have been to a considerable extent worked out afresh.

Table 103 shows that, in the matter of imports as well as exports per head of the population, Sweden stands in a comparatively favourable

TABLE 103. *Value in kronor of Imports and Exports per Inhabitant, for 1912.*

	Kronor per inhab.		
	Imports	Exports	Total
Sweden	142	136	**278**
Norway	223	138	**361**
Denmark	264	214	**478**
German Empire	147	123	**270**
France	150	122	**272**
Great Britain and Ireland	265	167	**432**
Russia	19	21	**40**
Europe	111	87	**198**

position as against the other countries situated in the same continent; she stands, for example, on a level with the German Empire.

Imports and Exports of Various Wares.

Detailed particulars as to the imports and exports of various special wares have already been given in the preceding pages, when dealing with particular branches of industry in Sweden. What now remains, chiefly, is to give a survey of the situation for goods considered by larger groups. The accompanying tables given provide the most general data.

A) We shall first consider such groups as show an excess of **imports** over exports.

Since about 1880, this has been the case with **cereals** and cereal products, of which there had been an excess of exports during the preceding forty years. For detailed information, reference should be made to the special section under Agriculture.

A class of merchandise that has always shown an excess of imports is **colonial wares,** of which we imported to a value of 60 million kronor in 1912, while the exports were insignificant. The most important article within this group is *coffee,* of which, next to coal, we import more than of anything else. Figures dealing with the consumption of coffee (which is the same as the import) have already been given for earlier and more recent times. In the year 1912, the total value of the coffee imported amounted to 30·69 million kronor. Next to coffee comes tobacco, raw and manufactured, (11·63 millions), which commodity has also received a more detailed consideration in the foregoing pages. *Sugar,* which was formerly imported to a value of some 10 million kronor a year, has of recent years been manufactured in sufficient quantities at home, but golden syrup, on the contrary, has been relatively largely imported (2·5 millions). — Of other colonial wares the greatest import occurred in 1912, to the values indicated: rice, 3·10 million kronor; cocoa and chocolate, 2·09 million kronor; tea, 0·62 million kronor; cardamom, 0·59 million kronor; pepper, 0·36 million kronor; cinnamon, 0·18 million kronor, etc.

Even of **fruits** and garden-produce the imports show a decided excess over the exports. The most important imports for the year 1912 are: hops, 2·08 million kronor; oranges, 2·06 million kronor; dried plums, 1·66 million kronor; almonds, 1·49 million kronor; fresh apples, 1·10 million kronor; potatoes, 0·96 million kronor; raisins, 0·80 million kronor; dried apples, 0·70 million kronor; preserves, 0·64 million kronor; grapes, 0·41 million kronor; onions, 0·32 million kronor; bananas, 0·30 million kronor, etc. *Red whortleberries* are now largely exported — in ordinary years to the value of more than 1 million kronor yearly (in 1909, 2·13 million kronor, and in 1912, 1·03 million kronor).

Liquors are imported to a value of nearly $9^1/_2$ million kronor a year, comprising chiefly *wines* (5 mill. kr.), *brandy* ($2^1/_2$ mill. kr.), *arrack* (0·79 mill. kr. in 1912), and *whisky* (0·67 mill. kr. in 1912). During the eighties of last century a Karlshamn firm carried on a brisk trade by importing raw spirit from Russia, which was then refined and exported, chiefly to Spain. But this trade was soon extinguished on account of increased import-duties imposed by the last-named country.

Textile materials were imported into Sweden to a value of 57·02 million kronor in 1912, but the exports only amounted to 2·30 million kronor. The wares which were imported to the greatest value were cotton (23·82 mill. kr.), wool (18·44 mill. kr.), jute, hemp, flax, etc.

Yarn, thread, spun goods, etc. were imported to a value of 18·76 million kronor in 1912; the most considerable items were woollen yarn (9·9 mill. kr.) and cotton thread (3·20 mill. kr.). The value of the exports amounted to 3·04 million kronor.

The **textiles** and other spun goods constitute the group of imports of which Sweden has to import the greatest amount to satisfy her needs. The total value of these imports amounted to 54 million kronor in 1912. This total was distributed as follows: fabrics woven wholly or partly of silk, 6·63 mill. kr.; woollens, 9·93 mill. kr.; cotton fabrics, 9·31 mill. kr.; linen, hemp, and jute fabrics, 2·22 mill. kr.; clothes (new) and household articles, 6·63 mill. kr.; hose, cotton gloves, etc. 3·56 mill. kr.; and so on.

From the statistics covering a succession of years we may conclude that no great increase in the import of textiles has taken place, but that especially the textile industry shows increased capacity to provide för home needs. Exports amount to $4^1/_2$ million kronor in value.

Hides and skins were imported (1912) to a value of 32·90 million kr.; other animal products (not foods) 1·5 million kronor, and such fertilizers etc. as can be included here about 0·5 million kronor. Unprepared hides were exported to a value of 15·30 million kronor; the export of other goods of this class was slight. The import of **articles manufactured from hides, skins,** hair, bone, horn, etc. amounted to about 5 million kronor, as against an inconsiderable export of similar wares.

Oils, tallow, resins, and such substances are collected in our statistics into one group, and the total import amounted in 1912 to 63·64 million kro-

TABLE 104. *Imports and Exports, in Groups of Merchandise.* In thousands of kronor.

Groups of merchandise		Annually 1871—75	Annually 1876—80	Annually 1881—85	Annually 1886—90	Annually 1891—95	Annually 1896—00	Annually 1901—05	Annually 1906—10	1911[1]
Living animals	Imp.	610	939	1 421	1 169	795	1 126	1 303	2 699	1 709
	Exp.	6 867	6 432	8 752	8 815	5 059	3 046	2 882	5 750	14 766
Animal foods	Imp.	17 673	23 901	21 479	16 829	16 275	22 035	26 924	27 754	21 290
	Exp.	6 946	9 534	18 707	40 450	59 288	49 272	45 043	51 267	72 807
Cereals and cereal products	Imp.	19 592	32 414	41 658	29 011	32 788	34 574	49 213	49 870	48 160
	Exp.	36 825	39 307	28 932	18 411	15 063	4 052	1 748	1 624	5 514
Colonial products	Imp.	37 101	44 076	40 604	50 115	47 688	40 952	39 263	44 760	59 479
	Exp.	72	97	177	691	1 136	301	468	568	938
Fruits and garden produce	Imp.	3 574	3 456	4 366	4 173	4 965	9 216	12 717	13 593	16 260
	Exp.	163	176	248	627	543	1 148	1 999	1 952	1 082
Spirituous and other liquors	Imp.	7 376	5 483	8 744	7 978	7 086	7 800	7 891	7 411	8 041
	Exp.	329	967	2 026	2 810	660	226	510	782	876
Raw textile materials	Imp.	20 558	16 842	20 433	23 864	20 592	24 666	35 353	47 323	48 622
	Exp.	307	294	394	366	122	176	455	804	878
Yarn, thread, etc.	Imp.	8 635	8 202	9 375	10 356	11 936	17 419	14 375	13 908	15 305
	Exp.	178	286	506	1 043	1 052	1 080	1 350	1 434	1 547
Manufactured textiles	Imp.	37 389	38 183	50 829	55 130	47 998	44 370	39 965	55 080	63 167
	Exp.	2 008	2 758	4 169	5 586	7 875	4 461	2 035	2 366	2 723
Hair, hides, bone, horn, and other animal materials	Imp.	14 000	14 210	15 474	17 156	18 105	22 717	24 566	34 670	40 303
	Exp.	1 179	1 071	1 485	1 689	2 595	4 145	6 198	8 598	15 947
Manufactures of do.	Imp.	880	1 425	2 484	3 412	3 023	2 917	2 610	3 158	3 741
	Exp.	211	68	100	342	656	545	284	198	104
Tallow, oils, tar, india rubber, etc.	Imp.	7 673	9 229	11 943	13 425	16 722	24 535	35 534	51 784	59 467
	Exp.	1 186	1 220	1 648	1 335	1 594	1 239	1 483	3 268	4 321

Manufactures of do.	Imp.	890	1 723	2 060	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3 565
	Exp.	133	243	400	797	836	1 028	2 797	2 414	2 724
Timber, unwrought, sawn, or cut	Imp.	754	724	1 486	1 544	1 929	3 601	2 747	7 658	12 031
	Exp.	16 444	76	15 573	14 955	16 933	18 339	19 745	20 520	18 951
Timber, wrought	Imp.	983	1 248	1 849	2 193	2 624	1 840	2 114	2 766	3 050
	Exp.	74 734	83 428	94 393	101 821	119 786	161 140	180 040	214 669	255 187
Colours, paints, and dyes	Imp.	2 320	2 046	2 605	3 409	4 376	5 751	7 061	6 685	6 918
	Exp.	169	212	343	374	322	294	189	279	222
Diverse vegetable matters	Imp.	5 109	6 549	9 175	9 594	11 941	17 982	33 172	40 348	45 754
	Exp.	656	735	1 091	843	762	533	780	1 710	3 745
Paper and manufactures of paper	Imp.	1 900	2 338	3 421	4 526	4 900	4 437	4 380	3 712	4 198
	Exp.	2 464	5 401	9 285	16 656	20 108	10 682	19 606	29 335	33 972
Other manufactures from vegetable matter	Imp.	151	161	323	493	827	1 990	4 435	3 554	3 125
	Exp	19	23	41	171	415	426	542	791	591
Minerals, raw	Imp.	18 756	18 354	23 895	31 598	40 645	69 252	80 541	90 572	89 403
	Exp.	1 077	1 413	1 747	4 196	9 131	18 544	30 939	46 311	69 045
Minerals, manufactured	Imp.	1 702	2 492	3 090	3 390	3 481	5 066	5 760	5 455	5 331
	Exp.	523	1 305	3 108	4 999	9 535	12 899	14 461	13 654	16 153
Metals, unwrought or partly wrought	Imp.	4 693	5 681	6 920	6 730	7 728	12 388	19 673	31 403	35 208
	Exp.	45 454	34 240	40 645	34 497	30 612	40 429	41 184	51 676	58 957
Metals, manufactures of	Imp.	9 363	7 579	11 796	13 581	17 458	25 581	31 255	32 978	33 968
	Exp.	1 536	1 388	4 335	4 248	4 975	9 074	13 296	18 025	20 495
Ships, vehicles, machines, instruments etc.	Imp.	14 061	10 038	12 514	15 145	17 494	35 208	32 980	42 131	40 486
	Exp.	1 182	1 524	2 773	3 619	5 394	11 554	18 049	31 170	50 118
Other articles	Imp.	1 930	2 612	4 164	4 457	5 622	7 684	10 125	16 017	21 868
	Exp.	594	985	2 484	3 127	3 310	3 918	4 351	6 193	11 873
Total	Imports	**237 673**	**259 905**	**312 108**	**331 528**	**349 479**	**446 146**	**527 503**	**638 501**	**690 449**
	Exports	**201 256**	**208 583**	**243 362**	**272 468**	**317 762**	**358 551**	**410 434**	**515 358**	**663 536**

[1] With the figures for 1912 it has not been possible to secure a quite reliable comparison.

TABLE 105. *Imports into Sweden of Coal and Coke, and Exports of Minerals.*

Annually	Value in 1 000 kronor	
	Import of coal and coke	Export of minerals
1871—75	13 452	1 077
1876—80	12 719	1 413
1881—85	15 847	1 747
1886—90	22 560	4 196
1891—95	29 770	9 131
1896—00	53 494	18 544
1901—05	58 723	30 939
1906—10	65 566	46 311
1911	61 654	69 045

Note. The statistics for 1912, which do not allow of direct comparison, give 91 615 and 81 031 kr. respectively.

nor, of which 22·2 mill: kr. was for mineral oils, 10·79 mill. kr. for vegetable fat, 8·82 mill. kr. for vegetable oils, 8·05 mill. kr. for raw rubber, 2·45 mill. kr. for tallow, 2·12 mill. kr. for resin, 1·07 mill. kr. for oleo-margarine.

TABLE 106. *Export of Iron Ore from Sweden.* In tons.

Year	Exported from		Total export	Of this was exported to:		
	Grängesberg [2]	Norrbotten		Germany [3]	England	Other countries
1888	31 144	70 622	**117 350**	39 192	65 406	12 752
1889	56 415	34 815	**118 573**	94 365	12 760	11 448
1890	103 875	27 520	**187 732**	158 550	6 390	22 792
1891	126 892	450	**174 148**	156 174	3 220	14 754
1892	126 515	139 194	**320 071**	296 780	11 371	11 920
1893	204 973	260 754	**484 055**	427 464	37 356	19 235
1894	289 267	525 729	**831 395**	727 419	85 197	18 779
1895	393 685	384 007	**800 452**	687 093	75 165	38 194
1896	496 102	625 795	**1 150 695**	955 105	87 203	108 387
1897	539 956	828 315	**1 400 801**	1 213 283	95 076	92 442
1898	579 787	821 267	**1 439 860**	1 258 487	101 600	79 773
1899	568 473	1 023 698	**1 628 011**	1 403 634	123 239	101 138
1900	531 904	1 054 675	**1 619 902**	1 389 874	102 772	127 256
1901	646 991	1 090 108	**1 761 257**	1 518 866	91 991	150 400
1902	609 070	1 074 434	**1 729 303**	1 358 958	173 726	196 619
1903 [1]	700 253	2 059 007	**2 827 428**	2 037 703	400 038	.
1904 [1]	670 305	2 317 010	**3 065 522**	2 224 633	543 489	.
1905 [1]	663 930	2 545 724	**3 316 626**	2 484 234	626 015	.
1906 [1]	786 663	2 775 475	**3 661 218**	2 941 245	582 449	.
1907	834 049	2 556 333	**3 521 717**	2 838 561	446 635	236 521
1908	709 602	2 805 718	**3 654 268**	2 948 386	450 014	255 868
1909	635 113	2 407 382	**3 196 453**	2 546 321	407 855	242 277
1910	883 087	3 312 510	**4 413 600**	3 276 605	584 185	552 810
1911	884 393	3 965 690	**5 086 898**	3 706 636	575 984	804 278
1912	951 981	4 205 150	**5 520 653**	4 217 958	621 881	680 814

[1] For these years the distribution between England and Germany of the ore exported over the frontier has had to be taken from the Norwegian trade statistics. — [2] Exported via Oxelösund. — [3] Including transit-traffic through Holland.

The exports amounted to 6·61 mill. kr., including wood-tar, 0·5 mill. kr. Of **manufactured articles** of the above description of wares, the imports amounted to 6·6 mill. kr., and the exports to 3·87 mill. kr., of which amount the export of galoshes accounts for 2·85 mill. kr.

Paints and colours amount to 6·5 mill. kr. among the imports (aniline and other tar dyes 2·49 mill., zinc white 1·43 mill.), while the export is scarcely worth mentioning. The group **various vegetable substances** shows imports to a value of more than 40 million kronor for 1912, while the exports do not amount to 2 millions. For the year in question, the most important imports comprised: oil-cake, 23·38 mill. kr., linseed, 6·65 mill. kr., cork bark, 1·61 mill. kr., flower bulbs, 1·37 mill. kr., etc. The imports of **articles manufactured** from such substances (exclusive of paper) amounted in value to 3·79 million kronor, of which tannic acid accounted for 1·80 million kronor; the exports scarcely exceeded $^3/_4$ million kronor.

As regards **unwrought minerals,** Sweden now exports considerable quantities, but the imports are far in excess, since they include *coal,* of which we

TABLE 107. *Imports and Exports, grouped according to uses*[1]. Values in thousands of kronor.

Groups of merchandise	Annually 1871—75	Annually 1876—80	Annually 1881—85	Annually 1886—90	Annually 1891—95	Annually 1896—00	Annually 1901—05	Annually 1906—10	Year 1911
Imports.									
Articles of food and consumption . . .	85 391	108 850	116 419	108 594	109 755	112 976	130 915	134 691	141 287
Clothing and toilet-requisites	38 021	39 504	54 167	59 602	54 093	50 006	44 935	59 670	69 137
Household articles etc.	17 882	21 857	31 319	37 075	39 513	53 735	61 216	70 821	70 170
Raw materials for manufactures . . .	80 531	78 885	94 814	109 471	120 670	188 178	240 518	311 500	342 006
Machinery and transport articles . . .	20 697	14 437	17 083	19 356	26 724	46 794	52 774	64 259	69 433
Coin	3 850	4 973	3 724	1 429	878	635	3 033	3 800	4 584
Total	**246 372**	**268 506**	**317 526**	**335 527**	**351 633**	**452 324**	**533 391**	**644 741**	**696 617**
Exports.									
Agricultural products[2]	52 311	56 913	58 688	70 563	83 107	62 280	59 680	71 166	113 856
Timber, unwrought and wrought . . .	92 255	99 679	110 930	116 384	137 242	180 138	200 520	236 415	275 623
Textiles	2 332	3 177	4 816	6 596	8 617	5 511	3 456	4 183	4 786
Products of paper industry	2 715	5 864	9 925	17 113	20 803	11 609	20 654	30 983	36 046
Minerals and mineral products	2 178	3 620	5 740	9 251	18 728	31 537	45 461	59 941	85 105
Metals and metal products.	48 520	36 398	46 635	41 499	40 276	60 361	70 424	96 524	122 331
Other merchandise .	1 899	3 206	6 628	11 088	9 371	7 144	10 251	16 149	25 828
Coin	2 315	1 000	337	135	82	1	1	—	—
Total	**204 525**	**209 857**	**243 699**	**272 629**	**318 226**	**358 581**	**410 447**	**515 361**	**663 575**

[1] According to the official trade statistics. In this classification slight changes have been made from that formerly employed in corresponding cases in this work. — [2] Including fishery products.

import greater quantities than of anything else. The development of our coal import and of the export of minerals is shown by Table 105.

From these figures for the import of coal and from the information regarding the increasing utilization of water-power, it ought to be possible to gain an idea of the country's industrial advance during recent times. (With regard to the attempt to substitute peat-mosses for coal, see p. 425.) Among the imports within this group are further to be noticed Chili salpetre, 7·55 mill. kr., stassfurtite, 5·77 mill. kr., raw phosphates, 3·87 mill. kr., sulphur, 3·46 mill. kr., and common salt (which necessary of life is not found anywhere in Sweden), 2·33 mill. kr. The total value of the imports included in this group amounted to 134 million kronor in 1912, while that of the exports amounted to 81 millions.

The export of iron-ore, which has been considerably increased since the railway between Gällivare and Narvik was opened, is shown in tons by Table 106 and in 1912 reached the total value of 59·72 million kronor. Other more important articles of export in this group amounted in value the same year to: cement, 3·37 mill. kr.; super-phosphates, 3·18 mill. kr.; block granite etc. 3·00 mill. kr.; and zinc ores, 2·65 mill. kr.

Of those wares that cannot be referred to any of the specified groups, which are arranged in one final group in the trade statistics of Sweden, the imports are also somewhat in excess of the exports (in 1912 respectively 9·65 and 3·11 mill. kr.).

If the exported and imported wares are classified according to the different groups of production we get the following result for the year 1912 (Table 108).

Of the 25 groups into which the commodities handled by the import and export trade of Sweden (apart from coin) are divided in Table 104 we have now dealt with 16. The total value of the imports included in these groups was 599 million kronor in 1912, while the exports did not reach more than 137 million kronor.

B) Groups within which the **exports** are in excess. To these groups belong chiefly the products of forestry, cattle-breeding, the stone industry, and the metal industries.

TABLE 108. *Imports and Exports according to Production Groups, 1912.*

	Imports		Exports	
	kronor	%	kronor	%
Products of agriculture, dairying etc.	273 649 000	34·87	130 648 000	17·18
» forestry and the timber industry .	20 751 000	2·64	192 701 000	25·33
» the sewing, and textile industry .	79 384 000	10·11	9 522 000	1·25
» paper industry	9 626 000	1·23	136 671 000	17·97
Minerals and products thereof, other than metals	140 243 000	17·87	115 745 000	15·22
Metals and products thereof	111 458 000	14·20	158 778 000	20·87
Products of other industries	149 756 000	19·08	16 561 000	2·18
Total	**784 867 000**	**100·00**	**760 626 000**	**100·00**

Among the articles of export a predominating position is taken by **timber,** which, in the statistical tables, is divided into two groups, unwrought and wrought, and which has, in some years, exceeded in value all the other Swedish exports together. The total value of the exports in 1912 amounted to 192 mill. kr., against 18 mill. kr. for imports. The most important items show the following values: sawn planks, boards, etc. of spruce and fir, 114·88 mill. kr.; planed boards of do., 20·03 mill. kr.; hewn timber of the same sorts, 9·34 mill. kr.; timber, 3·91 mill. kr.; unplaned casing, 7·99 mill. kr.; furniture, 6·04 mill. kr.; turnery articles, 5·08 mill. kr.; doors, 4·30 mill. kr.; coopering materials, 2·75 mill. kr.

Living animals and **animal foods** were imported to a value of 29 mill. kr. in 1912, but the exports amounted to nearly 100 mill. kr.. The import articles are chiefly *bacon* (1·70 mill.) and *salt herring* (8·17 mill.). The most important export articles are butter, 46·08 mill. kr.; cattle, 11·96 mill. kr.; bacon, 11·46 mill kr.; fresh (cattle-)meat, 5·99 mill. kr.; and cream, 3·11 mill. kr. Fresh herring is an important export article in years when the herring fishery has been productive (7·20 mill. kr. in 1912). Eggs are imported to a value of 3·29 mill. kr. and exported to a value of 2·69 mill. kr.

With regard to the group **machines etc.,** the imports have exceeded the exports up to and including the year 1909. Since then, however, the positions have been reversed, and in 1912 the imports amounted in value to 42·5 mill. kr., while the exports amounted to 57 mill. kr. Thus, in spite of the great demand for imported machinery, the industry has succeeded in creating a useful balance of exports, chiefly of power-engines and machines for dairywork and agricultural purposes. Among the exports for 1912, the following deserve special mention: separators, 13·37 mill. kr.; combustion and explosion motors, 8·34 mill. kr.; harvesting and mowing machines, 3 mill. kr.; electric generators and motors, 2·31 mill. kr., and telephone apparatus, 5·16 mill. kr. The imports for the same year included automobiles, 2·36 mill. kr.; sewing machines, 1·07 mill. kr.; and watches, 1·93 mill. kr.

The group **manufactures of mineral products** shows imports to the value of 7·39 mill. kr. in 1912, and exports to the value of 35·19 mill. kr. Of the exports 8·76 mill. kr. represent paving stone and 15·69 mill. kr. represent matches, which latter commodity is now referred to this group, according to the official statistics. Glass and glass-ware were exported to a value of 4·37 mill. kr., while the value of the imports was 2·81 mill. kr. The export of earthenware amounted to 4 mill. kr., while the imports showed a value of 2·23 mill. kr.

Of **unwrought or partly wrought metals** the imports amounted in 1912 to 38·58 mill. kr. in value, including pig- and scrap-iron, (9·03 mill. kr.) against 47·88 mill. kr. in exports. The most important of the typical exports of Sweden were, in 1912, pig-iron 16·77 mill. kr.; cold-rolled and cold-drawn iron in bars etc. above 10 mm in diameter, 5·43 mill. kr.;

TABLE 109. *The Trade of Sweden with Different Countries.*

Annually	In thousands of kr.		Percentage of the total[1]			In thousands of kr.		Percentage of the total[1]		
	Imports	Exports	Imports	Exports	In all	Imports	Exports	Imports	Exports	In all
	German Empire.					*Holland.*				
1871—75 . .	55 565	14 333	22·55	7·01	15·50	9 237	5 634	3·75	2·75	3·29
1876—80 . .	59 075	14 411	22·00	6·87	15·36	10 249	7 842	3·81	3·73	3·78
1881—85 . .	88 239	18 958	27·79	7·78	19·10	7 894	9 163	2·48	3·75	3·03
1886—90 . .	101 803	29 026	30·34	10·65	21·51	7 427	12 243	2·21	4·49	3·23
1891—95 . .	116 913	42 498	33·25	13·36	23·80	8 343	16 634	2·37	5·23	3·73
1896—00 . .	156 538	51 872	34·61	14·47	25·70	9 813	25 105	2·17	7·00	4·31
1901—05 . .	203 559	70 246	38·16	17·12	29·01	14 591	23 642	2·74	5·76	4·05
1906—10 . .	226 098	106 070	35·07	20·58	28·63	16 217	17 516	2·52	3·40	2·91
1911	244 188	133 518	35·05	20·12	27·77	19 394	23 927	2·78	3·61	3·18
	Great Britain and Ireland.					*Belgium.*				
1871—75 . .	81 362	108 228	33·03	52·91	42·05	5 943	8 943	2·41	4·37	3·30
1876—80 . .	77 223	109 084	28·76	51·98	38·95	8 068	9 691	3·00	4·61	3·71
1881—85 . .	82 333	119 468	25·93	49·02	35·96	9 139	8 906	2·87	3·65	3·21
1886—90 . .	92 875	126 029	27·68	46·23	36·00	10 236	9 572	3·05	3·51	3·25
1891—95 . .	95 152	140 485	27·06	44·15	35·18	10 356	10 724	2·95	3·37	3·15
1896—00 . .	138 072	153 828	30·53	42·90	36·00	14 161	13 457	3·13	3·75	3·41
1901—05 . .	138 887	154 169	26·04	37·56	31·05	16 245	14 958	3·05	3·64	3·31
1906—10 . .	164 147	173 783	25·45	33·72	29·13	9 147	14 034	1·42	2·72	2·00
1911	160 830	195 829	23·09	29·51	26·22	9 940	18 276	1·43	2·75	2·07
	Denmark.					*Russia.*				
1871—75 . .	39 193	22 371	15·91	10·94	13·65	14 666	2 825	5·95	1·38	3·88
1876—80 . .	49 184	22 267	18·31	10·61	14·94	20 665	1 645	7·70	0·78	4·66
1881—85 . .	52 862	28 610	16·65	11·74	14·52	23 373	2 597	7·36	1·07	4·63
1886—90 . .	44 350	32 006	13·22	11·74	12·56	21 344	3 293	6·36	1·20	4·05
1891—95 . .	41 375	38 829	11·77	12·20	11·97	14 875	4 341	4·23	1·36	2·87
1896—00 . .	55 455	43 987	12·26	12·27	12·26	20 640	5 100	4·56	1·42	3·17
1901—05 . .	61 022	54 312	11·44	13·23	12·22	25 176	5 051	4·72	1·23	3·20
1906—10 . .	44 885	51 775	6·96	10·05	8·33	24 564	12 127	3·81	2·35	3·16
1911	46 778	66 136	6·71	9·97	8·30	30 788	22 910	4·42	3·45	3·95
	Norway.[2]					*Finland.*				
1871—75 . .	12 939	7 139	5·25	3·49	4·45	4 938	3 346	2·00	1·64	1·84
1876—80 . .	14 213	7 029	5·29	3·35	4·44	6 743	3 433	2·51	1·64	2·13
1881—85 . .	20 489	9 841	6·46	4·04	5·40	7 237	5 100	2·28	2·09	2·20
1886—90 . .	28 283	14 376	8·43	5·27	7·01	6 649	5 360	1·98	1·97	1·98
1891—95 . .	31 203	17 018	8·87	5·35	7·20	5 037	6 121	1·43	1·92	1·66
1896—00 . .	25 037	11 875	5·54	3·31	4·55	7 433	9 977	1·64	2·78	2·14
1901—05 . .	23 586	25 850	4·42	6·30	5·24	7 016	9 007	1·31	2·20	1·70
1906—10 . .	22 583	27 724	3·50	5·38	4·34	10 945	11 316	1·70	2·20	1·92
1911	20 113	37 559	2·89	5·66	4·24	15 309	11 436	2·20	1·72	1·97

[1] Imports and exports and total trade with each country expressed as a percentage of the total imports and exports and trade of Sweden. — [2] Particulars of Sweden's exports to Norway are incomplete, especially before the year 1902.

TABLE 109 (contd.). *The Trade of Sweden with Different Countries.*

Annually	In thousands of kr.		Percentage of the total[1]			Annually	In thousands of kr.		Percentage of the total[1]		
	Imports	Exports	Imports	Exports	In all		Imports	Exports	Imports	Exports	In all
	France.						*United States of America.*				
1871—75	8 058	19 049	3·27	9·31	6·01	1871—75	5 522	5 095	2·24	2·49	2·35
1876—80	8 168	26 562	3·04	12·65	7·26	1876—80	7 613	1 195	2·84	0·57	1·82
1881—85	7 945	29 373	2·50	12·05	6·65	1881—85	7 894	973	2·49	0·40	1·58
1886—90	7 059	25 188	2·10	9·24	5·30	1886—90	6 711	1 791	2·00	0·66	1·40
1891—95	8 265	28 111	2·35	8·83	5·48	1891—95	11 754	772	3·34	0·24	1·87
1896—00	8 300	29 544	1·83	8·24	4·67	1896—00	9 312	199	2·06	0·06	1·17
1901—05	10 788	29 017	2·02	7·07	4·22	1901—05	16 955	1 976	3·18	0·48	2·00
1906—10	22 734	38 315	3·53	7·43	5·26	1906—10	56 454	14 744	8·76	2·86	6·14
1911 . .	32 231	48 510	4·63	7·31	5·94	1911 . .	54 656	24 280	7·84	3·66	5·80
	Other countries.						*Other countries.*				
1871—75	8 949	7 562	3·64	3·71	3·68	1896—00	7 563	13 637	1·67	3·80	2·62
1876—80	7 305	6 698	2·74	3·21	2·95	1901—05	15 566	22 218	2·92	5·41	4·00
1881—85	10 121	10 710	3·19	4·41	3·72	1906—10	46 966	47 958	7·28	9·31	8·18
1886—90	8 790	13 745	2·63	5·04	3·71						
1891—95	8 360	12 693	2·38	3·99	3·14	1911 . .	62 390	81 194	8·96	12·24	10·56

[1] See note 1 above.

wrought bar-iron, 5·31 mill. kr.; and crude bars and blooms, 5·22 mill. kr. Even as regards **metal-work** the exports (57·48 mill. kr.) for 1912 show an excess over the imports (45·46 mill. kr.). The most important exports were: hot-rolled iron (referred to this group) to a value of 28·26 mill. kr.; rolled or hot-drawn tubing to a value of 3·55 mill. kr.; horse-shoe nails, 2·31 mill. kr.; brass cooking apparatus, such as oil stoves etc., 5·91 mill. kr. The imports included the following articles: railway and tramway rails, 6·64 mill. kr.; girders etc., and other hot-rolled iron, 6·08 mill. kr.; iron tubing, rolled or hot-drawn, 3·01 mill. kr.; and electric cables and wiring, 4·51 mill. kr. — **Paper and paper-pulp,** 1912 imports 4·60 mill. kr., exports 134·31 mill. kr.

The nine groups dealt with above represent an import value of 186 mill. kr. and an export value of 624 mill. kr. for 1912.

A survey of the *imports* of Sweden, grouped according to the uses to which they are put, and of the *exports*, grouped according to the chief industries to which wares trace their origin, is given by Table 107.

In the above general view the feature calling for special attention is the fact that the imports of raw materials for the support of the industries show a relatively extremely important increase. We observe that in 1911 the importation of wares for feeding the *productive industries* amounted to 59·45 % of the total imports, and of this percentage 49·42 % is represented by raw materials and 10·03 by machinery, transport appliances, etc.

Of the imports of **articles of consumption** in 1912 — totalling 37·56 % of the total imports — 19·94 % is represented by articles of food and

consumption, 7·97 % by clothing and toilet requisites, and 9·65 % by articles of household use, etc.

Commercial Exchange with different Countries.

The countries with which Sweden carries on the liveliest trade are the German Empire, Great Britain, Denmark, Norway, Russia, and Finland; then come France, Holland, Belgium, and the United States of America. A point that demands attention is the important remodelling of the Swedish foreign trade statistics in 1905. Before that year, they were based upon the last foreign place of loading or unloading of the goods, as the case might be; while, from and including the year 1905, they refer to the country from which, in the case of imports, the goods have been bought or sent for sale or other purposes, direct or through another country, to Sweden. In the case of exports, they refer to the country to which the goods have been sold, or to the final destination to which they are dispatched, for sale or other purposes. Hence, e. g., the decline in the imports from Denmark which are given for the year 1905 ought to be attributed to this cause, rather than to any real changes in the conditions of trade. A survey of the Swedish trade with different countries since 1871 is given in Table 109.

Swedish exports to the **German Empire** comprised unwrought timber goods, joinery, paper and paper pulp, stone, iron-ore, bar-iron, other descriptions of iron and steel, herrings, red whortleberries, separators, meat, milk and cream, hides, etc. The imports comprised coffee, tobacco, wheat, rye, oats, seed, wool, paints and dyes, cotton, woollen goods, silk goods, articles of dress, hides, fertilizers, iron and steel, machinery, copper, etc.

Germany, with which country commercial intercourse has been very brisk ever since the days of the Hansa League — a commercial intercourse that has been regulated by detailed commercial treaties and agreements — has its chief importance for Sweden in the considerable import from there, partly of articles of food and consumption (the greater part of the import of wheat, a considerable part of the import of rye,[1] and the greater part of the import of coffee and tobacco), partly of raw materials for the textile industries, and, finally, partly of a multitude of industrial products, first and foremost clothes, but, besides, numerous products of Germany's metal and chemical industries.

It is at once apparent that, during the whole time, **Great Britain and Ireland** have played the most important rôle as regards Swedish exports, although during most recent years the total commercial exchange with Germany shows somewhat higher figures. At one time, more than half the total exports went to the first-mentioned countries; the fact that the proportion has been lower during recent years depends *partly* on the correction of Swedish trade statistics, which specially affected some

[1] Grain, however, is largely transit-merchandise from Russia.

of the exports to England. It is worthy of remark that, at least before 1905, a considerable part of the Swedish exports to Denmark were in reality exported to England through Danish intermediation. — Half a century ago, the importance of England as a buyer of Swedish products was not nearly so great as it has been during this last decade.

The Swedish exports to **Great Britain and Ireland** comprise unwrought timber goods, wood-pulp, paper, joinery, glass, matches, butter, eggs, bacon, rolled bar-iron, other descriptions of iron and steel, iron-ore, etc. The imports from Great Britain comprise coal, cotton, wool, shoddy, yarn, cotton yarn and thread, oils, iron and steel, copper, machinery, ships, rubber, etc.

As has been mentioned, Great Britain is the greatest buyer of the most important Swedish exports and supplies most of the coal consumed in Sweden.

To **Denmark** Sweden exports butter, paper pulp, super-phosphates, bar-iron, iron and steel goods, unwrought timber goods, etc. In return, Sweden imports from Denmark coffee, wheat, petroleum, other oils, and also oilcake, hides and skins, furs, textiles, etc.

Sweden has long had a brisk commercial intercourse with Denmark, thanks chiefly to the existence of Copenhagen as a free port for transit-merchandise.

To **Norway** are exported from Sweden cattle, textiles, wood pulp, certain timber goods, iron and steel goods, machinery, etc. The imports from that country comprise fish, hides and skins, sulphur pyrites, etc.

Next to Great Britain, **France** is Sweden's greatest buyer of unwrought timber goods, and a by no means insignificant buyer of iron and steel, as well as wood pulp. From France again Sweden imports brandy, wines, oil-cake, oils, silk fabrics, etc.

Sweden exports to **Russia** machinery, telephone apparatus, super-phosphates, iron and steel, metal work, furniture, etc. From Russia she imports grain, linseed, bran, eggs, flax, rubber, mineral oils, oil-cake, aspen wood, etc.

The principal Swedish import from **Finland** is unwrought timber, which is floated over the sea, and other articles, though not to any great extent. The exports to Finland consist chiefly of iron and steel, machinery, books, etc.

To **Holland** Sweden exports considerable quantities of timber, as well as paper pulp, pig iron, bar-iron, etc. The imports comprise coffee, herrings, arrack, fat oils, flower bulbs, etc. — The exports to **Belgium** comprise chiefly timber, paper pulp, metals, and ore.

The exports from Sweden to the **United States of America** comprise, for the most part, paper pulp and paper, partly manufactured iron goods, and iron-ore; whilst the imports from the United States comprise cotton, mineral oils, copper, grain, bacon, fertilizers, machinery, etc.

Trade with **other countries outside Europe** has advanced considerably

during recent decades, thanks to improved shipping communications. Thus for the following years, the value of the exports from Sweden, expressed in thousands of kronor, are as given in the table below.

	1905	1908	1910	1911	1912
British South Africa	4 567	3 844	9 089	7 183	6 949
British East Indies	3 226	3 549	4 478	4 585	5 955
China	733	504	1 381	1 840	1 255
Japan	608	2 274	5 565	5 866	6 359
Australia	2 693	5 080	8 895	9 800	8 499
The Argentine	1 100	3 032	5 183	7 422	9 405
Uruguay	40	94	346	842	571
Brazil	609	651	1 256	1 412	2 485

Customs.

With regard to matters concerning Commercial Policy, the reader may consult the special article below.

In order to give an approximate comparison in the matter of customs between Sweden and other countries from which figures are available, a few guiding data are given below. (In the case of Sweden the figures are taken from the returns for the year 1912; for other countries the figures represent an average for the period 1905—09.)

Countries	Customs collected. Per inhab. kronor	As percentage of imports
Sweden	11·53	8·2
Norway	17·94	11·9
Denmark	14·14	6·5
Great Britain and Ireland	13·56	6·1
German Empire	9·30	7·8
Switzerland	14·14	4·3
France	9·16	8·0
Spain	5·35	14·5
United States of America	13·00	23·0

How the conditions in this respect have changed in Sweden at different times is shown by the following figures:

Annually	Mean pop.	Value of imports, kr.	Customs receipts, kr.	Customs receipts Per inhab., kronor	Customs receipts In % of imports
1841—50	3 306 000	32 774 000	5 983 000	1·81	18·3 %
1851—60	3 642 000	70 549 000	10 270 000	2·82	14·6 »
1861—70	4 079 000	116 726 000	13 731 000	3·37	11·8 »
1871—80	4 387 000	257 439 000	23 690 000	5·40	9·2 »
1881—90	4 673 000	326 529 000	33 969 000	7·27	10·4 »
1891—95	4 832 000	351 633 000	37 372 000	7·73	10·6 »
1896—00	5 032 000	452 324 000	50 419 000	10·02	11·1 »
1901—05	5 214 000	533 391 000	55 704 000	10·68	10·4 »
1906—10	5 406 000	644 740 000	59 010 000	10·92	9·2 »
1911	5 542 000	696 617 000	60 273 000	10·88	8·7 »
1912	5 583 000	793 714 000	64 350 000	11·53	8·1 »

The transition to a system of freer trade, which followed immediately upon the year 1850, can be traced here with great clearness. With regard to the results of the new tariff of June 9th, 1911 (which came into force on Dec. 1, in the same year) reference should be made to the above mentioned separate article on Commercial Policy, from which more detailed information can be gained.

TABLE 110. *Customs Receipts on more Important Wares.*[1] In kronor.

Wares	Annually 1906—10	1911	Wares	Annually 1906—10	1911
Grain, unmilled . . .	9 765 000	8 456 000	Woollen yarn	497 000	582 000
milled . . .	1 137 000	873 000	Whole- and half-silk textiles	800 000	927 000
Meat and bacon . .	1 036 000	608 000	Woollen fabrics . .	2 409 000	2 338 000
Coffee	4 053 000	3 903 000	Cotton fabrics . . .	1 697 000	1 929 000
Sugar, refined and unrefined	416 000	248 000	Watertight fabrics .	971 000	932 000
Syrup and molasses .	1 514 000	1 503 000	Hats	467 000	567 000
Tobacco, raw and manufactured . . .	5 473 000	6 294 000	Hides and skins (not furs), prepared . .	638 000	701 000
Oranges	519 000	552 000	Paper and paper wares	602 000	758 000
Fruits, unspecified, fresh, canned, and dried	822 000	892 000	Iron and steel, unwrought & wrought	2 821 000	3 207 000
Plums, dried	539 000	545 000	Machines and tools .	3 235 000	3 391 000
Spirits	2 661 000	2 827 000	Other wares[2]	14 606 000	16 125 000
Wines	2 332 000	2 115 000	Total	**59 010 000**	**60 273 000**

[1] For the specified wares the amount of the import duties is only *calculated*. — [2] When the amounts given for the specified wares are only calculated, but the final total is the actual amount received, the figures for "other wares" must be to some extent incorrect.

In Table 110 is given a survey of those **wares** which, up to and including the year 1911, have produced the greatest revenue from import duties.

Table 111 shows the revenue from customs duties at the most important **custom-houses**. It may be pointed out with what comparative success Stockholm has been able to retain its place in the matter of the import trade, which was hardly to be expected in consideration of the circumstance that the Norrland towns have begun more and more to import their necessaries direct from foreign countries, instead of relying on the Stockholm merchants, as a result of which several new custom-houses have been established. Yet an inconsiderable decline is to be observed as a result of the circumstances indicated. Between the years 1861—65, Stockholm collected 37·0 % of the total import duties of the country, as

TABLE 111. *Customs Receipts, annual averages.* In thousands of kronor.

Custom house district[1]	1871—75	1876—80	1881—85	1886—90	1891—95	1896—00	1901—05	1906—10	1911	1912	1913
Stockholm .	9 345	9 635	11 197	12 166	12 995	18 516	19 853	20 814	21 009	22 595	24 378
Gothenburg	6 530	7 031	8 231	8 526	8 229	10 703	10 480	11 017	11 364	11 836	12 812
Malmö . .	1 949	2 195	2 703	3 167	4 037	5 161	6 441	6 639	6 626	6 689	7 541
Norrköping	783	888	1 164	1 580	1 650	1 762	2 030	2 012	2 498	2 940	2 997
Kalmar . .	191	177	167	321	515	1 154	1 823	1 703	1 632	1 849	1 585
Hälsingborg	407	445	584	694	1 101	1 723	1 699	1 645	1 616	1 846	2 317
Trälleborg .	39	32	21	13	19	271	742	982	1 397	1 726	2 135
Åhus . . .	114	74	62	305	422	998	1 160	1 267	1 272	1 614	1 493
Gävle . . .	442	565	772	1 186	1 028	1 371	1 401	1 330	1 394	1 531	1 649
Halmstad .	141	133	134	152	242	669	876	1 131	966	1 056	1 125
Sundsvall .	345	464	845	1 382	1 378	1 317	1 045	1 189	927	993	1 141
Landskrona	445	1 087	2 108	2 031	813	571	491	560	531	580	605
Ystad . . .	135	163	609	1 251	1 084	613	436	356	397	407	411
Other places	1 575	2 050	2 863	3 704	3 859	5 772	7 227	8 365	8 644	8 688	9 412
Total	**22 441**	**24 939**	**31 460**	**36 478**	**37 372**	**50 601**	**55 704**	**59 010**	**60 273**	**64 350**	**69 601**

[1] Towns that form custom house districts, i. e. are *staple towns*, are indicated, e. g. by Table 118.

against 35·3 % during the years 1906—10 (the corresponding figure for 1912 is 35·1 %). In the case of Gothenburg, this decline is considerably greater, possibly on account of the fact that Stockholm, in its turn, began more and more to take its supplies from abroad direct, instead of partly via Gothenburg, as it had done before. Specially noteworthy is the rapid development of Trälleborg, due to the steam-ferry service with Sassnitz, begun in 1909.

Customs-Tariff Legislation and Custom-House Establishments.

By the articles of the Swedish Constitution, it lies within the domain of the Riksdag to determine not only whether an article shall be liable to duty or not, but also the principles on which such duty is to be computed and its amount. The *Tariff (Tulltaxan)* enumerates all the various kinds of goods, the stipulations respecting exemption from customs-duties or the customs-duty rates, and the basis upon which these are to be calculated. The *Tare-Tariff (Taratariffen)* contains particulars of the amount of drawback that is allowed for packing materials in the calculation of the dutiable weight of certain articles. The *Customs-Tariff Ordinance (Tulltaxeförordningen)*, amongst other things, lays down the regulations concerning the concessions that hold good with regard to border traffic, concerning exemption from duty in certain cases, concerning the repayment of customs-duty paid on certain specific articles, and concerning the fees, called tonnage dues *(lastpenningar)*, imposed on vessels engaged in foreign commerce; while certain principles for customs-treatment are annexed to the Customs Tariff in the form of "Information as to certain points that are to be observed in the application of the customs-tariff". — In Sweden, there are now only *import-customs-duties*. The majority are specific; the levying of customs-duties on the basis of value occurs nevertheless with respect to a very considerable number of articles.

More detailed regulations respecting the manner of Customs taxation, control over the importation of goods, penalty in cases of unlawful import, and the like, are found in the *Customs Statute (Tullstadgan)*.

All vessels in Swedish waters are subject to the inspection of Customs Staff-Vessels coming from foreign ports are forbidden to put in at any places on the coast of Sweden except a Customs-station or the entrance-station to certain staple towns. The clearing of vessels and the unloading and passing through the Customs of cargoes from abroad must take place in a staple town (cf. Table 111 n.), or, if the ship does not contain goods liable to duty, at any other Custom-station.

Masters of vessels coming fom foreign ports and bound to a Swedish port must be provided with a *Manifest (Märkrulla)*, which is to be delivered to the Custom-House officer that comes on board. The Manifest, which must be drawn up on the lines of a certain formulary, contains certain information respecting the vessel, her crew and voyage, and also presents a clear account of her cargo. — The examination of the vessel takes place on her arrival at the port where she is to discharge her cargo.

The owner must deliver a written declaration of the goods that have arrived with the ship within eight days from the day when the Manifest was handed

to the Customs in the port of discharge, or, if the goods have arrived from another Custom-station by direct transit in bond, within eight days from the day of arrival. And now there takes place the customs-treatment of goods, i. e. the examination, and, for articles liable to duty, the computation and charging of such duty. This duty must be paid, or security given for the payment, before the goods are delivered to their owner. In any case the dues are to be paid within twenty days from the delivery of the Manifest, or, in the case of goods that have been transferred in bond, within twenty days of their arrival. This also holds good of ship's-dues.

With regard to navigation and export of goods *to foreign ports*, the loading may take place in any port whatsoever, provided only that notice of such loading be given to the Customs authorities in that place, or else to the nearest Custom-house. After the loading has been completed, the master of the vessel is required to hand in bill of cargo and the owner to deliver a declaration. Where these documents have been handed in and the fees paid, the masters is given an official discharge.

There are special regulations concerning foreign navigation with smaller mercantile vessels, concerning decked vessels and open boats engaged in certain kinds of fishing, and also concerning steam-vessels used in foreign trade, as well as the Custom-house inspection and passing of passengers' effects; and rules have been drawn up for the purpose of expediting the examination of steamboats with regular sailings, and the passing through the Customs of the goods therein.

There are also certain regulations for the control of *coastwise navigation* and the coastwise movement of goods. The vessels thus employed, unless they are passenger steamers with regular sailings or only navigate the Customs-district of their own port, or only lakes, rivers and canals, must be provided with so-called annual permits, and even goods should in some cases be accompanied by a transire.

Even *attempts* to import articles that are subject to duty without proper declaration of the same are punished as illicit importation of goods.

Customs Stores (*Tullager*) in Sweden have long comprised Bonded Warehouses, Transit Warehouses, and Free Victualling Stores; and to these have been added in Customs legislation (but not, as yet, in actual use) three new kinds — Free Harbour, Free Stores, and Drawback Warehouses.

In *Bonded Warehouses* (*Nederlag*) dutiable goods, after they have been officially examined, are warehoused under lock and key of both owner and Custom-house; but no customs-duty is paid on them till they are removed for home consumption. Goods may also be re-exported from the bonded warehouse. Buildings for this purpose are provided sometimes by the town, sometimes by the owners of goods. The fee for bonding is one per cent of the total duty charged. The maximum time for bonded-warehousing is five years. The proprietor is allowed to look after and take care of the goods, and take samples of them in suitable small quantities. Re-packing and racking may be permitted after special examination, but only, as a rule, when there is danger of injury or destruction of goods in consequence of defect in the wrapper or vessel, always to a very limited extent.

In a *Transit Warehouse* (*Transitupplag*), goods arriving from abroad are stored under lock and key of the Customs without examination on the part of same. The goods thus warehoused may afterwards be passed through the Customs, moved to another warehouse, or re-exported. The right of transit-warehousing is only conceded to certain towns, which have to provide buildings for the purpose. Only piece-goods may be stored in this way. The period is a year; and the fee accrues for a period of three months at the rate of 70 öre (about 9d.) for the first and 35 öre (about 4d.) for the following periods per 100 kg. The

owner is not allowed to look after or take samples of the goods stored in this manner.

Free Victualling Stores (*Proviantering*s*frilager*) may, under certain conditions, be established in a sea-port that has a Custom-house: they are intended to facilitate the provisioning and general supply of vessels touching at the port. The charge for goods kept in such stores is in certain cases reckoned as one per cent of the duty on the goods.

A *Free Harbour* (*Frihamn*) means a certain part of a port which, from a Customs point of view may be regarded as a foreign place. A concession for a free harbour may be obtained by a municipality or by a company consisting of Swedish shareholders. From a free harbour goods may be either exported or placed on the home market.

Free Stores (*Frilager*) are, in the main, intended to form a simple and cheap kind of free harbour and are not restricted to maritime towns. In free stores goods may be received and warehoused, repacked and divided without being examined or passing through the Customs. The Government's consent is required for the right to carry on any industrial work in such stores. Retail trade is allowed neither in a free harbour nor in free stores.

The intention of a *Drawback Warehouse* (*Restitutionsupplag*) is that an article consisting wholly or partly of foreign materials worked up within the kingdom, the import duty paid on which is wholly or partly repaid on export, may, instead of being immediately exported, be stored in a staple-town in a warehouse standing under the control of the Customs authority. When the article is thus entered, the customs duty is repaid, or, in cases where the duty has not been paid but security therefore has been deposited, the deed of security is restored and the amount charged in the books is written off.

The Riksdag of 1912 petitioned the Government to institute an inquiry as to whether permission to establish *Credit Warehouses* (*Kreditupplag*) might profitably be granted in such a way that it might benefit those forms of industry which concerned themselves with the working up of dutiable goods for export.

The **refunding of Customs-duty** by way of drawback is allowed by the Customs Tariff Ordinance for materials and necessaries for the building, rebuilding or repair of ships at a dockyard or works in Sweden and for certain goods manufactured in Sweden from entirely foreign raw materials, such as cocoa-powder, maccaroni, manufactured tobacco, certain paperwares and textile fabrics, jute canvas for packing etc., the refund for which is fixed at a certain amount per kg. A refund is also allowed to persons engaged in the milling industry, on the export of rye-flour and wheat-flour, for the customs-duty which they may have paid on a corresponding quantity of grain imported from abroad in accordance with fixed rate of exchange; that is to say, for such meal, in which Swedish grain has been blended, compensation may be enjoyed provided that a corresponding quantity of foreign grain has been previously imported. Moreover the customs-duty may be refunded with the special permission of the Government, on foreign commodities which, with or without the addition of Swedish raw materials, have been used in the production of export goods.

Finally from the year 1913 there has been introduced in certain cases customs-refund on the re-export of foreign goods, whereby is meant the right conferred on firms of good repute to receive back the customs-duty paid on import when they re-export foreign goods that have not been worked up or altered within the kingdom. This right to refund, for which is paid a special fee amounting to one-half per cent of the customs-duty, embraces only certain kinds of goods determined by the Government; and for some of these it is provided that the right to refund shall not be enjoyed unless the owner of the goods certifies

that it is not intended to send back the goods either to the country of production or of purchase or to any foreign agent of the producer or seller.

Laboratory of the Customs Training School, Stockholm.

The Customs Establishments. The *Royal Board of Customs (Generaltullstyrelsen)* has charge of the local Customs administration, of the Coast-guard and of the Frontier-guard. The *Customs Service (Tullverket)* looks after the collection of Customs-revenue — i. e. customs-duties on imports, tonnage dues, fees for bonded-warehouses, transit-warehouses, free victualling stores, and customs-refunds — and also the tax on sugar imported from abroad and dues for lights and beacons. The Customs Service has also to collect certain statistical information concerning trade and navigation, to see to the observance of the laws that aim at preventing the introduction of infectious diseases into the kingdom, or that provide for prohibition or control in the import or export of certain goods, as to goods with incorrect statement as to place of origin, poisonous substances, meat, margarine, certain forest productions; and in the event of a ship going on shore or suffering shipwreck, the Department has to exercise supervision and protect the rights of the Crown.

The *Royal Board of Customs* is divided into four sections: the secretariate, the exchequer office, the audit office, and the examination and information office. Besides exercising a general guidance and control over the entire

Customs administration, the Royal Board of Customs has to act as a Court of first instance in settling disputes between the owners of goods and the local Customs authorities, and to give official information beforehand concerning the Customs treatment of goods. Executive details are handled by the *local Customs authorities*, which in Stockholm and Gothenburg are divided into special sections: the Custom-house, the Collector's Office, the Confiscation Office and Counting House, Warehouse Inspection, Bonded-Warehouse Office, and Preventive Service. The country is divided into 48 *Custom-house Districts*, one for each staple-town (see too page 556). In addition to those in the staple-towns, there are Custom-houses in Lund, Borås, Falun, and Östersund, and at the railway stations of Mon, Charlottenberg, Storlien, and Riksgränsen. Besides these fully equipped Custom-houses (*Tullkamrar*), there are a number of minor centres for Customs and Frontierguard service known as "*inspektioner*", "*stationer*", and "*expeditioner*"; but of these only those on the frontier have unlimited rights for Custom purposes.

For the training of candidates for Customs-service, and for existing members of the service, the Customs Department has a special Customs Training School (*Tullverkets Undervisningsanstalt*), where instruction is given in articles of merchandise, customs-regulations and living languages.

The *Coastguard Service* (*Kustbevakningen*) in the Stockholm Custom-house District is under the chief preventive officer in that town; in Skåne and Blekinge and also in the läns of Halland, Gothenburg and Bohus, it is under the Coastguard Commanders; and elsewhere it is managed by the Surveyors of Customs. The Coastguard has at its disposal a coastguard steamer and a considerable number of revenue cutters (usually motor-boats) and smaller vessels.

The *Frontier-guard Service* (*Gränsbevakningen*) in Dalsland, Värmland and Dalarne is under a Frontier-guard Commander; elsewhere, under certain Surveyors of Customs.

To conduct suits concerning breaches of Customs regulations there are special *Customs Prosecutors* (*Tullfiskaler*) established in certain districts.

The State's Customs expenses amounted to the following percentage of the receipts: in 1870, 11·7 %; in 1890, 5·8 %; and in 1913, 9·3 %.

Commercial Policy.

Although in most countries State intervention in commercial matters is now far less extensive than formerly, it is nevertheless of great importance. Home trade is, indeed, left entirely free nowadays; but foreign trade is regulated by means of customs duties, commercial treaties, and also by direct measures for facilitating export. A brief review of the recent history of this subject, supplemented by a conspectus of existing conditions will serve to show how matters have shaped themselves in Sweden.

Sweden's commercial policy enters on its modern phase in the middle of the late 'fifties. As early as the twenties of the nineteenth century considerable modifications had indeed been made in the rigorously prohibitive economic policy, in the spirit of the Mercantile System, which had long been traditional, but it was not until the 'fifties that it was definitely broken away from. In conformity with the views then generally held, a change was made to a system rather favourable to free trade; all the prohibitions against import that still survived were abolished, articles of food and most raw materials were made free of duty, and the remaining duties were lowered.

When these reforms were introduced into Sweden, nearly all the countries on the continent of Europe still adhered to the old Mercantile System; Sweden was, thus, one of the very first countries to follow England's example in this respect. Theoretically, however, free-trade theories were everywhere in vogue, and in the 'sixties these theories were actually carried into practical effect. The first step was "Cobden's Treaty", the free-trade Treaty concluded between England and France in the year 1860. On the basis of that Treaty, France concluded a series of similar treaties with most Western European countries. Sweden's turn came in 1865, when, partly in response to French demands and partly of her own free will, her customs tariff, was further revised decidedly in favour of free trade. At this time, the easy and rapid victory of free trade was looked upon all over Europe as a foregone conclusion; the committee which was appointed in Sweden to draw up proposals for the new customs tariff, in submitting its proposals in 1865, recorded as its opinion that free trade was the only policy and avowed that it looked upon its own proposals merely as a transitional step to a free-trade system.

At the end of the seventies, however, an abrupt revulsion of opinion occurred on the continent of Europe. Bad times and falling prices, more especially those of cereals, soon gave rise to a powerful movement in favour of a rigorous protective policy, embracing all branches of industry. It was then that "protection" in the modern sense of the word became a vital factor in practical politics, and as early as the eighties customs duties on articles of food and increased protective duties were introduced in several countries: the definite transition to the present system came in the course of the early nineties, when many commercial treaties expired.

In Sweden no steps were taken until the latter period. The eighties were occupied with a violent struggle between free-trade and protection, in which, as in several other countries, the latter come off victorious. In the year 1888, the introduction of duties on articles of food was resolved upon, and even as regards general industries protective duties were to be increased as soon as the expiration of treaties made untramelled action possible; this occurred in 1892. This step laid the foundation of Sweden's present system of protection; for a long period merely minor alterations were made, of which the majority entailed a further increase in protective duties; the chief of these was the raising of the duties on cereals to their present figure, in the year 1895.

The most momentous recent event in Swedish commercial policy was *the commercial treaty with Germany and the consequent revision of the customs tariff.*

When the old commercial treaties expired in the year 1892, Sweden, like several other smaller countries entirely abandoned the system of tariff treaties. The later treaties, therefore, did not contain any mutual concessions as to the amount of the duties imposed, but merely the "most favoured nation clause", i. e. that each party is as a matter of course to enjoy such advantages as are granted to any other power. Sweden's position was under such conditions extremely favourable. She had full liberty to raise her own duties and was under no obligation to make any concessions; she entered, as it were, automatically into the enjoyment of all such reductions as the various countries conceded to each other, without having to grant any favours in return.

The country which felt this condition of things most was, for obvious reasons, Germany. That country in fact decided to compel Sweden, as well as some other minor countries in a similar position, to enter into a regular tariff treaty. Accordingly, in the new tariff which was issued at the end of 1902, some duties specially levelled at Sweden were introduced, e. g. upon paving stones and red whortleberries, besides which the duties on coarser joinery, separators, etc., were greatly increased.

These duties struck at the most vulnerable points in Sweden's export trade with Germany, and the object aimed at was gained: Sweden applied to Germany with a request for negotiations. It was, however, now discovered that the Swedish customs tariff was quite antiquated and would have to be submitted to a thorough revision before any definite result could be attained. All that was done therefore was to conclude a preliminary treaty in the year 1906, which, after an extension to which Germany had acceded, remained in force until Dec. 1, 1911. In this treaty the duties most fatal to Swedish export were removed or reduced.

In this manner Sweden gained time to elaborate, through the instrumentality of a committee, a proposal for a new tariff, which, with minor alterations and amendments, was passed by the Riksdag of 1910. The most characteristic feature of this treaty is a thorough-going specification of the various kinds of goods. Whereas the old tariff contained 740 headings, the new one embraces no less than 1 325. The earlier treaty scheduled chiefly semi-manufactured and coarser goods; the various kinds of finer, finished goods were only very incompletely, or not at all, specified, and therefore did not receive any greater protection than the coarser articles.

On the basis of the new tariff negotiations were then opened with Germany, and a great number of mutual concessions were made, so many that a detailed enumeration of them is out of the question. It must suffice to say that Sweden, on the whole, succeeded in safeguarding the advantages gained in the year 1906. Sweden, on her part, granted to Germany a reduction on a great many goods, especially leather goods and textiles, and undertook not to impose any export duty on iron ore. As Sweden retained her single tariff system, the reduced duties immediately passed into the new tariff, which came into force on Dec. 1, 1911. The treaty is to be in force, unless terminated by one of the parties, until the year 1921; it may, however, be terminated any time after the year 1917 after one year's notice, and it is quite probable that it will be so terminated by Germany.

It is not possible to determine directly how the *rates of the duties* have varied under the various customs tariffs. The rate of a duty can be gauged only if it is expressed as a percentage of the value of the goods imported, but this is rendered difficult by the fact that most — in the 1911 customs tariff practically *all* — duties were not *ad valorem* but were levied on quantity. However, by an *indirect* procedure it is possible to form some idea of their value, namely by deducting from the total imports the amount of imported raw materials, on which duties can scarcely be imposed under any circumstances, and then calculating the percentage of revenue from customs duties on the remainder of the imports. In this way we arrive at the result that the duties during the seventies amounted to about 13 %, and during the eighties to about 15 %, of the value of the goods. These figures, however, include both protective and revenue duties. If we deduct the latter, the average protection during the eighties works out at 6 % to 7 % of the value.

We now come to the application of the new system in the years 1888 to 1892. What effect has resulted from the introduction of duties on cereals is not clearly shown by the figures of these years for *all* the duties; an increase certainly sets in in the years 1888 to 1891, but in the years 1891 to 1892 there is again a standstill at about 15 %. After this, however, there ensues a considerable rise at the rate of about 1 % per annum, up to and including the year 1896, when 19 % was attained. Afterwards the figure keeps at 19 % to 20 % up to and inclusive of the year 1904. The extent of the change will obviously be brought out far more clearly, if we consider solely the protective duties; these latter rose in fact from an average of 6 % to 7 % to about 17 %.

With the year 1905, there sets in quite a considerable fall; for the following years the figure for all duties fluctuates between 17 % and 18 %, for the protective duties solely between 15 and 16 %, which is equivalent to an average fall of 1/10 in the rates of the duties, and this in spite of no appreciable reductions having occurred. This must be ascribed to the way in which prices kept going up from the end of the nineties. The duties are, as has already been mentioned, levied on the *quantity*, not on the value of the goods. Thus, when a certain rate has been fixed for a certain quantity, but that quantity continually rises in price, the duty forms an ever diminishing portion of the value; a period of rising prices like the one in which we are now living ought thus to entail a continuous fall in the protective effect of duties. On account of the reform of the tariff, rising and falling markets, unsatisfactory statistical data as to value, and other factors, this tendency certainly receives but imperfect expression in the figures, but we see from the above inquiry that it is nevertheless distinctly perceptible.

For the year 1911, the figure thus obtained was 17 %. The average rate of duty ought, however, to be put at something slightly higher, as, besides the group of raw materials, there are some goods which, in Sweden as well as in other protectionist countries, are exempt from duty; if we deduct these also, the figure obtained will be 18 %. The new customs tariff of Dec. 1, 1911, has not entailed any change in this respect; the figure calculated for the year 1912 according to this principle also works out at 18 %, and for the year 1913 at 17 %. In this regard Sweden comes very close to Germany, where the corresponding figure for a number of years has been 19 to 20 %, and with Norway, where it is about 19 %. For Denmark again, which is mainly a free-trade country, the figure is about 8 %. On the whole, it may be said that customs duties in Sweden stand at about the normal figure for protectionist countries, and rather below than above it.

These figures, however, do not constitute a reliable index of the effective *protection*, as they include both revenue and protective duties, which for this purpose must be separated. In the case of Sweden, matters stand as follows.

The revenue duties are, as a rule, higher than the protective duties. In Sweden they average about 30 % of the value. They are imposed principally on three different kinds of goods. The most important is the duty on tobacco, which, however, like the duty on alcohol, may be looked upon, to some extent, as a protective duty. This duty is 1 krona per kg for unmanufactured tobacco, which may only be imported by a concessionaire under the State Monopoly, 1 krona 80 öre for pipe-tobacco, snuff and the like, and 6 kronor for cigars and cigarettes; on an average, the duty is about 50 % for manufactured goods and over 80 % for unmanifactured. Next in order comes the duty on wine and spirits, which amounts to about 55 to 60 % of the value. The third, the duty on coffee at 12 öre per kg, is, on the other hand, one of the lowest duties, amounting to only about 10 % of the value.

The protective duties are on an average about 15 % of the value, which was also the case when the earlier tariff was in force; the new tariff has therefore not entailed any change in the rates of the protective duties. The protective duties may be divided into duties on articles of food and industrial duties.

Amongst the *duties on articles of food* the most important are undoubtedly the *duties on cereals*. These latter are, for all kinds of cereals except oats and maize, which are free of duty, 3·70 kronor per quintal for unmilled grain and 6·50 kronor for milled. This makes, in proportion to the value, (still following the figures of the trade statistics), for unmilled wheat 25 %, and for rye 30 %, for flour again 32 and 43 % respectively. Both wheat and rye flour fall under the category of goods on which the heaviest duties are imposed. For sugar the

duty is 11 öre per kg (from 1916 it is to be 10½, and from 1918 10 öre), corresponding to 37 % of the value, and for margarine 15 öre, or 15 % of the value.

As regards *general industries*, the most important duties are those on textiles. These are, however, so numerous, that it is impossible to enumerate the different rates. The *ad valorem* duty on different kinds of *yarns*, however, may be estimated at about 7 %; on *silk* fabrics it is 14 %, on cotton fabrics 18 % and on woolen fabrics 20 %. The duty on boots and shoes is 6 kronor per kg; as the boots and shoes imported are of the more expensive sorts, this only represents 25 % of the value; this figure, however, includes the protective duties for the domestic tanning industry. The duty on *galoshes* is 1·20 kronor per kg, or 25 % of the value. Further, it might be mentioned that the duty on *glass-wares* is ¼ to ⅓ of the value; on *cement* 60 öre per quintal, representing above 20 % of the value; on *semi-manufactured steel and iron* 16 %, if duty-free goods are deducted, otherwise 5 %; for *iron and steel goods*, if goods exempt from duty are deducted, 25 %, otherwise 14 %. For *machinery* in some cases the *ad valorem* duty of 10 % has been retained, and in no case must the duty fall below 5 % of the value; on an average it amounts to 10 %.

As to the *benefit* which various industries receive from the duties, this can be estimated only in certain cases. The sugar-duty may be taken by way of example. The sugar factories sell more than 130 million kg of sugar annually, and as the price is usually raised above that of foreign sugar, up to the limit, or very nearly to the limit which the duty allows of, the Swedish people pay to the sugar factories and the sugar-beet growers in the shape of higher prices 11 öre per kg, i. e. between 14 and 15 million kronor per annum. Most of the other industries, however, do not permit of an estimate of this kind being made, until exhaustive investigations, which are not yet made, have been instituted.

Duties are intended, of course, to protect home production and to restrict import. It is thus quite natural that the State should also encourage the sale of Swedish goods to foreign countries, and endeavour to increase the export trade. Formerly, export premiums were resorted to for this purpose. These have now been abolished, but, as a set-off, countries with State railways, more particularly Germany, have introduced remarkably low *export tariffs*. Sweden resolved, in 1912, to introduce these low export rates, principally for iron and steel, manufactures of iron, machinery, paper, and cardboard. These tariffs are, however, merely provisional and are likely to be considerably extended. (Cf. also the preceding section on Customs-Tariff Legislation and Customs-House Establishments.)

Inland Trade.

The **Inland Trade** of Sweden has at all times been of great importance for the development of the country. Considerably facilitated by the excellent waterways — which have to a certain extent been a necessary factor in the country's onward march in civilization — the communications between the different parts of the country have always been particularly brisk. Still more has inland trade been forwarded by the modern means of communication on land, and, and by liberal trade-legislation, which did away with the guild-system, with its clogging restrictions on trade.

The total number of *traders* in Sweden, which in 1845 amounted to only some 7 000, had increased to 37 729 in 1911, employing 54 591 hands (more recent figures not available).

During the greater part of the Middle Ages, and far long afterwards, attempts were made to centralize practically *all* trade in the towns, and one of the factors in this policy was the ban on anything which could be called *rural trading*. As early as during the latter half of the 13th century, we meet with a prohibition against such trading. The town markets were the only places where country people were allowed to dispose of their goods; though in a few cases permission was given for the exercise of trade outside the towns. In the Swedish towns, markets and market days were instituted, which often attracted people from distant regions, such as, the fairs at Uppsala, Enköping, Västerås, Örebro, Strängnäs, Växjö, etc. Gustavus Vasa rendered more stringent the old prohibitions against rural trading. Thus, according to an edict of 1546, whoever was caught exercising such unlawful trade for the third time was punished with death. Exceptions were made only for the most northerly parts of the country. In consideration of the fact that there were no towns up there, a few rural traders were permitted in every parish; otherwise the country people had to go to the towns to buy or sell. Later on, however, several exceptions were made from these stringent regulations against rural trading; thus, for example, in 1569 the nobles obtained the right of trading in the produce from their own estates.

In the beginning of Gustavus Adolphus' reign, the principles which can be traced in Gustavus I's measures were strengthened and found expression in the trade ordinances of 1614 and 1617. By the terms of the former of these, inland trade was reserved to **inland towns,** while foreign trade was exclusively allotted to the **staple towns.** By the latter of these ordinances, the regulations were so far modified that the staple towns acquired the right to sell their wares direct to the country people at the markets of the inland towns, by which the trade of the inland towns became considerably curtailed.

Few sovereigns have exerted themselves to such an extent to develop the inland trade of Sweden as Gustavus Adolphus, even though the results did not correspond to the magnitude of his efforts. Inland trade was especially checked by the "petty customs", imposed in 1622 and not abolished until 1810, which were levied on all "eatable and perishable" home wares brought to any market in the kingdom. However, the petty customs were one of the chief causes of the constitution of new towns, which was continued by Axel Oxenstierna after the example of Gustavus Adolphus.

For a long time, the inland trade of Sweden continued in the old ruts. Still, in the beginning of the Period of Liberty, the statutes against rural trading were revived, and the peasantry were forbidden to carry on coastal shipping by means of sloops. By degrees, however, the oppressive shackels were loosened. In 1748, the Government declared that "hereafter provincial governors must not lay any obstacles in the way of the towns and their trade and industry, by imposing any prohibitions against the export in their vessels of wares to Stockholm and other towns in the country". After the notable Riksdag of 1765—66, a law was issued on the 20th of November, 1766, according to which country people were declared to be free to carry on shipping to all places within the kingdom and to dispose of their wares and agricultural products at any place or places they deemed suitable. During Gustavus III's reign also, matters developed in the same direction. The trade in grain was freed from restrictions in 1775, so that everybody, irrespective of rank or grade, was allowed to trade in grain, both in town and country.

In 1832, the inland shipping of the coast population was freed from all restrictions, and they were even given the right to sail to Finland, Norway, and Denmark. Of far greater importance were the changes introduced in 1846. By the ordinances of Dec. 22, the same year, opportunities were afforded for

trading in the rural districts, although under certain conditions and at specified distances from the towns. The ordinance of June 18, 1864, was more radical and permitted almost unconditional freedom of trade. By later ordinances, however, *peddling* has been made subject to special permission from the local provincial authorities.

The important old *fairs,* at which trading in all kinds of goods was free, have lost a great deal of their importance in our own days and are becoming superseded by the more frequently recurring *market days* and *monthly meetings,* at which agricultural produce and the products of home industries (hemslöjd) etc. are sold, and by regular *cattle markets.*

The inland trade of Sweden is largely carried on by means of very numerous, but generally small, *steamers,* which maintain a brisk traffic in the innumerable lakes and water-ways, and along the coast. During the most recent decades, however, the *railways* have entered into keen competition for this trade. The *highroads,* along which in earlier days there passed an endless succession of gigantic loaded waggons — which provided the chief means of subsistence over large stretches of the country — have, however, lost more and more of their importance for inland trade, except for the more distant regions of North Sweden, where, to a large extent, things have naturally remained where they were.

Commercial Education.

As far back as 1734 a Trade Statute prescribed a certain period of apprenticeship (generally from 11 $^1/_2$ to 12 years) as a condition for the right to carry on a trade, and also enacted that the applicant should be examined in commercial subjects by two business men. The employer was certainly required to give his apprentice not only practical experience, but also a theoretical knowledge of his trade; but it is clear that these amounted to very little as a rule, and with the expansion of trade and the increasing importance of the mercantile community, the need of real commercial schools became more and more pressing.

The first known commercial school of any importance was founded towards the end of the 18th century at Öringe in Halland by Councillor *Wurmb,* without doubt the same man who had previously aided in the establishment of the Commercial School at Hamburg. The number of its pupils at times reached 40, and many of the merchants who, at the beginning of the 19th century, were regarded as the most prominent merchants in Gothenburg had received their mercantile education there. However, about 1790 the founder and owner of the school went into bankruptcy, and the establishment was closed.

The manifest decline in the commerce of Sweden during the second and the early part of the third decades of the 19th century caused public attention to be directed once more to the lack of business training among the mercantile community. The Riksdag of 1823 therefore urged the desirability of establishing commercial schools or a central "Commercial and Navigation Institute". The motion was referred to the Gothenburg Mercantile Society, and led to the establishment of the *Gothenburg Commercial Institute,* which was opened in 1826 under the auspices

of the Society. Its existence was assured — as far as finances go — in 1829 by a yearly grant of 2 000 Rdr. bco. (= 3 000 kronor) from the town. At first about 30 pupils were instructed at the Institute, which number diminished considerably in the forties, but soon rose again to about 40. On the model of the Gothenburg Commercial Institute was founded, in 1865, the Stockholm Merchant Society's commercial school, *Frans Schartau's Practical Commercial Institute*, named after the man who, by his energetic intervention, effectually contributed towards mitigating the consequences of the commercial crisis of 1857. But a really marked advance in commercial education had to wait till the early nineties, when the institutes first received Government grants. In 1893 the Riksdag voted a grant of 15 000 kronor for the year 1894 to the two existing commercial institutes. The grant was renewed in the years immediately following, at the same figure, but was increased in 1898 to 20 000 kronor, and in 1902 to 28 000 kronor. With the support of the communal authorities, new *commercial institutes* were founded (1904) in *Malmö* and *Hälsingborg*. The Malmö institute participated in 1908 in the government grant, which was raised in that year to 38 000 kronor, and in the year following to 42 000 kronor. The same support was granted in 1912 by the Riksdag to the Hälsingborg institute.

The Government appointed a Committee in 1908 to investigate, and make suggestions for systematizing, the commercial education of the country. However, the report of this committee (1910) gave the Government no inducement to propose any general organizing of commercial education; but in 1913 the Riksdag agreed in the main to the Government's proposal to raise the grant to the higher commercial institutes, which were to be known in future as "*commercial gymnasiums*[1]". The regular estimates included a grant of 85 000 kr. to the commercial gymnasiums in Gothenburg, Stockholm, and Malmö. In 1914 the Riksdag decided upon the establishment of two new commercial gymnasiums, in Örebro and Norrköping, and at the same time raised the ordinary grant to 115 000 kronor. The Hälsingborg Commercial Gymnasium received an extra-ordinary grant of 10 000 kronor per annum.

In 1909 was opened, in Stockholm, the first *High School of Commerce* (Commercial University) in Sweden, about which more information is given below.

A. Higher Commercial Education. The Riksdag having made considerably increased grants to higher commercial education in 1913, the Government issued a communication on November 28th of that year, which stipulated the conditions on which these grants may be enjoyed. But in all essentials the various School Boards have retained their old functions. The most important change is the reduction of the fees to 150 kronor per annum for pupils in the two-years' course.

The instruction is afforded by the five State-supported *commercial gymnasiums*, mentioned above, in *Gothenburg*, *Stockholm*, *Malmö*, *Hälsingborg*, and *Örebro*, together with the *Gävle Borgarskola*, which was accorded equal rank with the other institutions. The commercial gymnasium in Norrköping has not yet begun operations.

The organization of these institutions is similar.

The course takes two years to complete. At the commercial institutes in Gothenburg and Stockholm there is also a one-year's course.

To gain entrance to the two-years' course at the State-aided schools, applicants must, as a rule, have attained a standard of knowledge equal to that of the

[1] A »commercial gymnasium» is a higher commercial school.

6th form in the public secondary schools. Most of the applicants have passed the "Realskole"-examination (see p. I, 385 foll.).

The subjects of instruction are: a) *obligatory:* Swedish, German, English, French, Book-Keeping, Commercial Arithmetic, The Science of Commerce, Chemistry and Knowledge of Merchandise, Commercial Geography and the History of Commerce, Economics, Political Science, Commercial Law, Shorthand, Calligraphy, and Type-writing; b) *optional:* Spanish and Russian.

To the higher one-year's course, only those students are admitted, as a rule, who have passed the "Student"-Examination (Matriculation see p. I, 385 foll.). The subjects are the same as for the two-years' course, though a somewhat greater freedom of choice is usually permitted.

At Schartau's Commercial Institute there is also a lower one-year's course, intended for pupils from senior forms below the Matriculation Form, or for those who have gone through the 8 forms of the girls' secondary schools. At the Hälsingborg and Malmö Institutes, pupils with higher attainments, especially those who have passed the "Student"-Examination, may enter the second-year's forms at once.

Pupils of both sexes are admitted to all the courses. During the Autumn Term of 1914 the number of pupils at the commercial gymnasiums was as follows: Gothenburg 191 (including 27 girls), Stockholm 155 (23), Malmö 57 (5), Hälsingborg 41 (9), Örebro 34 (17), Gävle 9, (1), making a total of 487 (82).

The average age of those admitted to the two-years' course is somewhat over 17.

A pupil who has gone through the full course in a satisfactory way, and has taken the written and oral examinations, receives a certificate testifying to his diligence and good conduct during the courses, and specifying the degree of proficiency he has attained in the subjects studied.

A certificated pupil has the right to a further examination in any subject in which he has not yet been approved, or in which he has not attained a high degree of proficiency.

A satisfactory pass from the commercial gymnasiums' two-years' course, together with the "Realskole"-examination, gives the right of entrance to the High School of Commerce in Stockholm, qualifies for an appointment in the Customs Service or in the Bank of Sweden, and for a cadetship in the reserve. The same pass, without the "Realskole"-examination, qualifies for an appointment under the State Railways Board, or in the traffic department of the State Railways.

In conformity with the statute of November 28, 1913, a permanent staff is to be appointed in the State-supported scholastic institutions. Members of the staff are to receive at least the same remuneration as assistant masters in the public secondary schools, i. e., 3 000—5 000 kronor pro tem.

The head-master is to receive, in addition to his stipend, the sum of not less than 2 000 kronor. In point of fact, the remuneration of the staff in Gothenburg and Stockholm exceeds by 500 kronor per member the minimum rate of remuneration appointed by statute, and the head-masters are also placed on a more favourable footing. At the Gothenburg Commercial Institute, both the head-master and the members of the staff are entitled, on reaching the age of 65, to a pension of 4 000 and 3 000 kronor, respectively. The Gothenburg Commercial Institute has at present on the permanent staff a head-master and 6 assistant masters, the commercial gymnasiums in Stockholm, Malmö, and Örebro, a head-master and one assistant on the permanent staff, each. At the Hälsingborg Commercial Gymnasium the post of head-master is filled by a member of the staff of one of the public secondary schools there. The Gävle Borgarskola has a staff of four masters, exclusive of the head-master.

The financial position of the commercial institutes was formerly dependent mainly on the pupils' fees, which were fairly high, varying between 225 and 320 kronor per annum. A considerable number of the pupils, about 50 % at the two older institutes, were however excused part of or all the fees, thanks to the Government grant, which was shared between the two institutes in proportion to the remissions conceded. From 1914 onwards, the annual fees for pupils in the two-years' course are 150 kronor, and in the one-year's course they are slightly higher. Exemption from fees, either in whole or part, still goes on, though the need for the latter has somewhat diminished.

The State grant is fixed at a certain maximum figure for each of the gymnasiums, viz., Gothenburg 40 000 kr., Stockholm 30 000 kr., Malmö and Örebro 15 000 kr. each. The commercial gymnasium in Hälsingborg enjoys, as we have before mentioned, an extraordinary grant of 10 000 kr. All the commercial gymnasiums are furthermore supported by the communes or mercantile corporations. A distinct position is occupied by the Gävle Borgarskola, which has at its disposal donations amounting to over 1 100 000 kr. It enjoys no State grant, but has an annual grant of about 2 000 kr. from the town.

At *Påhlman Brothers' Commercial Institute* in Stockholm, a higher two-years' course, starting at the standard of the "Realskole"-examination, has recently been organized on the pattern of the commercial gymnasiums. It is also Government-inspected.

Kristinehamn Practical School has a one-year's course with the same entrance qualification.

The commercial gymnasiums are under the control of the Board of Trade, chiefly excercised by a commercial inspector appointed by the Government.

B. Lower Commercial Education in Sweden has not yet taken a settled form. The committee mentioned above, which considered the question of commercial training, had held out the prospect of the establishment of lower-grade commercial schools in a large number of towns. Delegates who have since been summoned recently proposed the establishment of 4 two-years'-course commercial schools for pupils who have passed through the 6 years' course in the elementary schools, and of 4 one-year's-course commercial schools for pupils with the same qualifications plus at least two years' practical work in the service of trade or industry, who during the said period have attended continuation classes.

Of the two-years'-course commercial schools, only one was to be independent; the remaining three were to come into being by remodelling higher elementary schools, and were to remain in close touch with elementary school instruction in general.

In common with the higher commercial schools, these latter were also to be under the inspection of inspectors of commercial education.

The annual cost of these 8 schools, once they have got into full working order, is estimated at 76 400 kr.

Some scheme for the working arrangements of the commercial evening schools may be expected before long.

Of the existing lower commercial schools, the most important is the commercial side of the *Stockholm Borgarskola,* started in 1887, which includes both day and evening classes. The school itself was founded in 1836, enjoys a considerable grant from the City of Stockholm, and has a very large number of pupils. Further may be mentioned *Sundsvall Commercial Institute,* which also has day-courses, *Landskrona Technical Trade-School and Commercial Institute,*

the evening classes of the *Society for the Advancement of Commercial Knowledge in Gothenburg,* the *Practical Schools in Karlskoga* and *Kristinehamn,* the *Norrköping Higher Commercial Institute* (Gustaf Smedman), and *Krok's Commercial Institute in Hälsingborg* All these institutions receive grants from their respective municipalities.

Proprietory schools for teaching writing and commercial subjects — sometimes with very pretentious names — are, moreover, to be met with in all the large towns and in many smaller ones. As a rule they receive pupils without regard to their grounding, and allow them full freedom in their choice of subjects for study. However, some of the larger and better schools have methodically arranged courses for a year, a term, or a shorter period, which aim at imparting suitable instruction, adjusted to the point of view and the aims of the pupils, in the more important commercial subjects, at times including languages, commercial law, economics, etc. Such are *Påhlman Brothers' Commercial Institute* in Stockholm, *Filip Holmqvist's* and the *Gothenburg Private Commercial Institute* (Benno Rosenbund) in Gothenburg, and *Bendtz Brothers' Language and Commercial Institute* in Malmö. The lack of control over the private commercial schools, in Sweden as in many other countries, has in a number of cases caused certain drawbacks. Yet an undoubted tendency towards improvement has shown itself in recent years.

C. The High School of Commerce in Stockholm was founded on the initiative of bank-director K. A. Wallenberg of that city, now Minister for Foreign Affairs. In 1903 he donated a sum of 100 000 kronor to start a fund for a commercial and economic university college, and in 1906 set afoot the establishment of the High School of Commerce Association, whose object was to set up and develop a Swedish university college of commerce. Thanks to the magnanimous generosity of bankers, commercial companies, and private merchants, and to the decision of the Town Council of Stockholm in 1907, to appropriate for the purpose the sum of 475 000 kronor from the Forsgrén Fund in Stockholm, the Association was able to proceed to carry the scheme into effect in 1909. In this manner the High School of Commerce could enter upon its work on October 1st, 1909. At the suggestion of the Government, the Riksdag voted a grant of 30 000 kronor towards the working expenses of the High School, a grant that has been renewed in subsequent years. The expenses of the High School during the academic year 1913/14 rose to about 133 000 kronor.

At present there are professors in Economics (with Statistics), Science of Commerce, Economic Geography (with the science of raw products), Jurisprudence, and Political Science (with the history of economics). Five lectors in modern languages, mostly natives, give instruction in German, English, French, Russian, and Spanish. There are also docents and assistant masters. Next to the lectures, the practical classes and courses play an important part. After two years' study, the pupils are held to be sufficiently prepared to enter for the so-called "examination in economics", which comprises the compulsory subjects Economics, Commercial Science, Economic Geography or Jurisprudence, and one language, and the optional ones, i. e. any other subject taught at the High School. There is a special examination for those who intend to be teachers of commercial subjects. The fee is 250 kronor a year, to which must be added the entrance and examination fees.

Thanks to generous donations, the High School is able every year to let a considerable number of its examined students complete their education by a stay abroad. Journeys about Sweden, intended to give an insight into the economic life of the country, are undertaken annually under the guidance of the teaching staff; a certain proportion of the students take advantage of these opportunities.

The High School contains a collection of business records, a well equipped geographical institution, and a technical library of some 11 500 vols.

From the first, the High School has had a much larger attendance than was anticipated. According to the Calendar, there were 180 students during the Autumn Term of 1914. The majority of these had passed the "Student"-Examination, but entrance can also be obtained by certificates from the higher commercial institutes and technical schools, while at the option of the Teachers' Council, other applicants with satisfactory qualifications may be admitted to the courses. Some of the lectures are also attended by external students. The High School also arranges for popular lectures on scientific subjects, intended for the general public, which deal with various themes of immediate interest in the sphere of economics.

A scheme is being prepared at Gothenburg *for academic courses similar* to the above; sufficient donations having been received, the courses will begin in 1915.

Commercial Legislation.

The regulations in force concerning the carrying on of trade are to be found in the *Royal Ordinance of June 18, 1864*. Anyone and everyone has unconditional liberty of carrying round for sale necessaries of life, agricultural and farm produce, and the productions of Swedish domestic industry. Anyone who has announced his intention of carrying on any manufacturing or handicraft trade, has likewise a right himself to carry round for sale, or have carried round by his wife or by any of his children living at home, the articles of his own manufacture or production, it being, however, necessary for the person so engaged to have with him or her a certificate as to his or her identity as well as a certificate, issued by the proper authority, concerning the character of the trade pursued by the person for whose benefit the goods are offered for sale. Furthermore there is full liberty with regard to trade at fairs.

In other respects a Swedish man or woman only enjoys the right to carry on trade, to export to and to import from foreign parts, and to transport goods from one place to another within the country, subject to the conditions and restrictions mentioned below.

The right to carry on *wholesale trade*, or to sell goods *in a shop or from other place of storage*, accrues to anyone provided he or she be of good repute, be of age and in unrestricted possession of his or her property and have besides lodged an application in writing for the right to do so at the offices of the Governor of the Län (in rural districts) or the Magistracy (in towns). Certificates with regard to the conditions named having been complied with must accompany the application. If an application is made for a *firm* in accordance with the regulations prescribed, such application is considered to fulfil the requirements also of the Ordinance respecting the Liberty of Trade. The stipulation with regard to being of age and in unrestricted possession of one's property is *dispensed with* in the following cases: a married woman living with her husband,

a person under age, a tradesman who has been placed under the charge of a trustee, — provided that the husband or the trustee is willing for the business to be carried on and assumes responsibility for the obligations incurred in connection therewith by the wife or the minor or the ward respectively.

In certain cases *a special licence* is requisite for the carrying on of trade. Such cases arise: firstly when a tradesman desires to dispose, in a short space of time, of a stock of commodities at some other place than the one where he has applied for the right to carry on business, or at a place where he has not yet established permanent business premises, and in other manner than that prevalent at a fair, for instance by auction or by private sale (*Clearance Sales*), and secondly when a person desires to carry round articles himself or send someone else round with them in his stead in a district other than that where he resides for purposes of sale by other methods than those holding good at fairs (*Pedlar's Sales*). The right to carry on a pedlar's trade without a special licence is, however, accorded to anyone who has lodged an application in writing for the privilege of carrying on trade, at any place where, owing to the application in question, business premises of a permanent character shall have been established. Together with the application for a licence, written testimonials must be handed in, certifying that the tradesman himself and the assistant or assistants whom he intends to employ to aid him in the selling, are of good repute for honesty and straightforwardness. Those who have not previously made an application for the right to carry on trade are required also to hand in a certificate of good character and a document to show that they are of age and are in unrestricted possession of their own property; the last-named is not essential for a married woman living with her husband, provided his permission is attested to her project. The granting of a licence to a person to hold a clearance sale as above delineated involves a fee of from 25 to 500 kronor. The licence may be at any time withdrawn if due cause for such a measure should be deemed to have arisen.

To the unrestricted enjoyment of the right of carrying on trade in Sweden there are sundry exceptions, viz. for the occupants of certain official positions such as tax collectors, public prosecutors, officials in the customs department; the restriction applies likewise to the wives of these officials.

In certain cases there are special regulations in force concerning the kind of business carried on. Among these are (*a*) the selling of corn brandy, potato spirit or any other distilled spirituous liquors; (*b*) the selling of wine, beer, bottled non-alcoholic beverages and small beer; (*c*) the trade in margarine, margarine-cheese and artificial lard; (*d*) the selling of poisonous substances; (*e*) the trade in medicines; (*f*) the trade in ether and in commodities containing either ether or spirits; (*g*) the trade in explosives and inflammable oils; and (*h*) the import and export of gold and silver goods. It ought to be mentioned that the *book-trade* is excepted from the general trade legislation, the regulations for it being given in the Liberty of the Press Law.

The Board of Trade has to consider and determine with regard to the holding of *fairs*, their discontinuance etc., and for that purpose to hear the opinion of the parties concerned. A list of fairs is published in the Official Swedish Almanack.

With respect to *assistants in shops and places of business* the reader is referred to the section of the present work dealing with Labour Questions.

IX.

SHIPPING AND NAVIGATION.

Historical.

It is natural that Sweden with its long coast-line and many harbours, its abundance of rivers, and innumerable inland lakes should always have made our nation a sea-faring one. Still the history of our foreign shipping shows many vicissitudes, and times of progress have not seldom been followed by a decided decline. At present the realization of the need for improvement in Swedish shipping asserts itself more and more, as well to the trading community as to the legislative authorities.

The short summary given in the preceding pages of the history of Swedish commerce also comprises the leading features of that of shipping. Still the latter shows certain peculiar characteristics, and, on the whole, it is of course not necessary that the shipping and the commerce of a people should show parallel development, though, as a rule, this has been the case in Sweden.

During the famous "*Viking Age*", the sea voyages of the Scandinavians were longer and more daring than those of any other nation. When, during the latter part of the Middle Ages, wars were carried on more by land than by sea, the naval defence fell into decay, and therewith not only did the old superiority at sea of the Scandinavian peoples cease, but for a certain time also the seamanship of the people and their taste for navigation ceased too. Instead of the Scandinavians, the Hanse towns became masters of the Baltic and the North Sea, and appropriated to themselves shipping as well as commerce. King *Gustavus Vasa* (1523—60) tried to revive in his Swedish people their former skill in seamanship and naval architecture, and how he in some measure succeeded has already been mentioned above.

During the seventeenth century, great efforts were made by sovereigns and statesmen to promote Swedish shipping, and to a certain extent with success. That the result was not better was principally due to the unequal competition with the Dutch.

The wars of Charles XII (1697—1718) were ruinous for Swedish shipping as well as for other trades. In the beginning of the decade 1721—30, the Swedish merchant fleet is said to have numbered only about a hundred vessels. After

the issue of the above-mentioned "Proclamation" of 1724, however, it made such rapid progress that towards 1730 it already amounted to about five hundred vessels. Through the East India Company Swedish shipping with distant countries was also considerably advanced. A splendid period was entered upon during the American War of Independence (1775—83), in which the greater maritime powers gradually became involved, owing to which their shipping declined, to the benefit of the neutral powers. As already indicated above, the Swedish shipping has probably never been more profitable than during that time.

The Mercantile Marine.

During the long period of peace which Sweden has enjoyed since 1814, its shipping has undergone no small development, although its relative importance is scarcely the same as during preceding periods. Of the combined mercantile marines of all nations, the Swedish comprised, in 1850, about 2·66 % — reckoned according to the "reduced" tonnage (see Table 112), and using the epoch-making maritime statistics of A. N. Kiær. In 1865 this had gone down to 1·92 %. During the next decade, more especially during the beginning of the decade 1871—80, a tremendous improvement occurred, which, in 1875, advanced the figures to 3·22 % of the world's tonnage, but after that came twenty years that constituted one af the feeblest chapters in the whole history of Swedish shipping. Then the mercantile marine was not even 2 % of the world's tonnage. Since the end of the decade 1891—1900, however, another period of improvement has been entered upon, and at present the figures for Sweden's mercantile marine can be reckoned to be 2·36 % of those given for the total of the shipping of all countries. — The progress of the development since the middle of the nineteenth century appears from Table 112.

TABLE 112. *The Swedish Mercantile Marine.*

(Before 1900 all vessels; from 1900 inclusive, vessels of 20 tons and over.)

At the end of	Number of vessels	Total net tonnage	Sailing vessels	Steam ships			"Reduced" tonnage[2]	Steamships in %[3]
			Tonnage	Tonnage	Do. multiplied by 3	Horse-power[4]		
1850 . . .	2 744	205 800	201 800	4 000	12 000	?	**213 800**	5·6
1860 . . .	3 200	283 600	271 600	12 000	36 000	6 000	**307 600**	11·7
1870 . . .	3 376	350 200	319 300	30 900	92 700	11 601	**412 000**	22·5
1880 . . .	4 333	552 400	461 600	90 800	272 400	24 601	**734 000**	37·1
1890 . . .	3 874	510 947	369 680	141 267	423 801	37 843	**793 481**	53·4
1900[1] . . .	2 987	613 792	288 687	325 105	975 315	67 317	**1 264 002**	77·2
1910[1] . . .	2 849	769 985	176 912	593 073	1 779 219	466 410	**1 956 131**	91·0
1911[1] . . .	2 758	765 068	154 968	610 100	1 830 300	481 805	**1 985 268**	92·2
1912[1] . . .	2 793	805 386	153 827	651 559	1 954 677	514 144	**2 108 504**	92·7

[1] See note immediately under heading. With regard to the figures previous to 1900, they are certainly somewhat too high for the tonnage, and much too high for the number of vessels. — [2] The tonnage of the sailing vessels + three times that of the steam vessels. — [3] The steam vessels' effective tonnage (i. e. tonnage multiplied by three) expressed as a percentage of the whole of the "reduced" tonnage (previous column). — [4] Before 1910 the nominal, after 1910 the indicated horse-power.

As has been the case in other countries during recent times, the *number* of vessels has rather decreased than increased, whilst the *tonnage* has grown — though the latter circumstance is only true of steam vessels.

TABLE 113. *The Swedish Mercantile Marine during 1912.*

Tonnage-groups Home-ports	Steam-ships			Sailing vessels		Total		
	Number	Gross tonnage	Horse-power	Number	Gross tonnage	Number	Actual gross tonnage	"Reduced" tonnage [1]
A) **Groups:**								
Of 20—50 tons. .	77	2 887	3 231	391	14 794	468	17 681	23 455
» 50—100 » . .	180	13 246	18 215	689	48 658	869	61 904	88 396
» 100—200 » . .	280	43 585	45 438	237	31 847	517	75 432	162 602
» 200—300 » . .	109	25 725	24 274	98	23 887	207	49 612	101 062
» 300—500 » . .	99	38 954	31 658	92	34 436	191	73 390	151 298
» 500—700 » . .	72	42 817	31 404	14	7 996	86	50 813	136 447
» 700—1 000 » . .	76	64 305	37 145	12	10 048	88	74 353	202 963
» 1 000—2 000 » . .	254	363 820	168 377	5	5 929	259	369 749	1 097 389
» 2 000 tons–ω » . .	107	330 241	154 402	1	2 057	108	332 298	992 780
Total	**1 254**	**925 580**	**514 144**	**1 539**	**179 652**	**2 793**	**1 105 232**	**2 956 392**
B) **Home-ports, by läns:**	Number	Net tonnage	Horse-power	Number	Net tonnage	Number	Actual tonnage	"Reduced" net tonnage [1]
Stockholm town . . .	250	148 643	115 612	24	2 643	274	151 286	448 572
Stockholm län	68	6 991	15 277	170	19 015	238	26 006	39 988
Uppsala	7	703	1 390	2	85	9	788	2 194
Södermanland	16	1 590	3 145	13	582	29	2 172	5 352
Östergötland	32	11 539	9 364	47	3 671	79	15 210	38 288
Jönköping	10	1 353	1 710	7	253	17	1 606	4 312
Kalmar	37	13 417	11 692	197	25 640	234	39 057	65 891
Gottland	8	2 095	3 020	33	3 173	41	5 268	9 458
Blekinge	25	19 644	12 164	44	2 833	69	22 477	61 765
Kristianstad	3	527	360	177	31 316	180	31 843	32 897
Malmöhus	186	180 686	126 513	162	19 417	348	200 103	561 475
Halland	13	4 833	5 600	62	5 591	75	10 424	20 090
Göteborg och Bohus .	330	204 922	156 934	420	29 508	750	234 430	644 274
Älvsborg	32	2 387	2 820	36	1 849	68	4 236	9 010
Skaraborg	16	1 577	1 680	63	3 281	79	4 858	8 012
Värmland	66	10 147	9 548	34	2 039	100	12 186	32 480
Örebro	18	1 728	2 169	16	808	34	2 536	5 992
Västmanland	3	432	740	3	97	6	529	1 393
Kopparberg	5	226	443	3	101	8	327	779
Gävleborg	45	24 782	16 589	16	1 263	61	26 045	75 609
Västernorrland . . .	57	11 882	13 604	3	132	60	12 014	35 778
Jämtland	12	607	1 245	—	—	12	607	1 821
Västerbotten	6	315	935	2	358	8	673	1 303
Norrbotten	9	533	1 590	5	172	14	705	1 771
Bottniska viken [2] . .	117	37 512	32 718	26	1 925	143	39 437	114 461
Östersjökusten [3]. . .	455	218 260	190 129	708	89 297	1 163	307 557	744 077
Västkusten [4]	513	376 627	269 552	641	54 092	1 154	430 719	1 183 973
Other counties [5] . .	169	19 160	21 745	164	8 513	333	27 673	65 993
Total	**1 254**	**651 559**	**514 144**	**1 539**	**153 827**	**2 793**	**805 386**	**2 108 504**

[1] Sailing ships' tonnage + three times steam ships'; cf. Table 112. — [2] The four most northerly coast läns. — [3] The läns on the Baltic (and *all* the county districts of the län of Kristianstad). — [4] Malmöhus, Halland, Göteborg och Bohus läns, excepting the towns of Ystad and Trälleborg. — [5] Läns which do not touch on the sea.

TABLE 113 (cont.) *The Swedish Mercantile Marine during 1912.*

Tonnage-groups Home-ports	Steam-ships			Sailing vessels		Total		
	Number	Gross-tonnage	Horse-power.	Number	Gross tonnage	Number	Actual gross tonnage	"Reduced" tonnage [1]
C) **Home-ports, certain towns:** [2]								
Gothenburg	266	193 822	143 035	22	7 486	288	201 308	588 952
Stockholm	250	148 643	115 612	24	2 643	274	151 286	448 572
Hälsingborg	92	101 223	59 845	35	6 420	127	107 643	310 089
Malmö	35	28 607	24 870	1	505	36	29 112	86 326
Gävle	29	21 501	13 313	4	180	33	21 681	64 683
Landskrona	22	19 997	11 920	4	1 502	26	21 499	61 493
Trälleborg	15	13 781	19 335	—	—	15	13 781	41 343
Sölvesborg	8	9 751	5 465	5	266	13	10 017	29 519
Karlshamn	14	9 250	6 001	14	658	28	9 908	28 408
Oskarshamn	13	8 086	6 303	24	3 448	37	11 534	27 706

[1] See note 1 on page 549. — [2] Towns which possess the largest shipping fleets.

As regards sailing vessels, in recent years we observe everywhere a decrease, as well in number as in burthen. However, the decline in sailing vessels began later in Sweden than in other countries, increase being observable there until about the year 1880.

The Swedish mercantile marine's notable inferiority during the period 1881—90 is chiefly due to the fact that the fleet of *steam ships* was not developed in conformity with the exigencies of the time. Sweden had many steam ships, but they were, as a rule, small — a natural result of the fact that her shipping was limited to the waters in the near neighbourhood of Sweden. During the last decade, however, a notable improvement has shown itself, which is connected with the development of trans-atlantic steamboat lines. In the year 1901 was built the first vessel of over 3 000 tons net tonnage, and now there are no less than 19 vessels of a tonnage exceeding that figure. The largest has a tonnage of 4 444 tons net tonnage. Whilst in the year 1898 there were only 5 vessels of 2 000 tons and over, net tonnage, the corresponding figure is now 56.

A classification of Swedish trading vessels according to their size and home ports, by läns and leading towns, is given in Table 113. In 1912 there were 1 083 *steam ships built of iron or steel*, while 56 were built of *wood*, and 115 of wood and iron combined. The gross tonnage of steam vessels built of iron or steel amounted to 899 080 tons, for ships built of wood to 6 353 tons, and for ships built of iron and wood combined to 20 147 tons. Of the steam vessels added to the merchant fleet during 1912, 23, of a net tonnage of 3 707 tons were built in Sweden, and 44, of a net tonnage of 51 348 tons were acquired from foreign countries. Of the *sailing vessels* only 18, of a gross tonnage of 8 316 tons, built of iron or steel, as against 1 508 vessels, of a gross tonnage of 170 012, built of wood, and 13 vessels, of a gross tonnage of 1 324 tons built of wood and iron combined. 9 sailing vessels, 649 tons net tonnage, were built in Sweden during the year 1912, while 55 vessels, of 8 812 tons net tonnage, were acquired from abroad.

Below are given some figures concerning the more important shipping companies of Sweden (end 1913).

Some important Swedish Shipping Companies (end 1913).

Shipping Companies	No. of Vessels	Gross Tonnage
Ångfartygsaktiebolaget Tirfing, Gothenburg	20	69 114
Stockholms rederiaktiebolag Svea, Stockholm	74	64 880
Rederiaktiebolaget Luleå—Ofoten, Stockholm	16	59 175
Rederiaktiebolaget Nordstjernan (Johnson Line), Stockholm	16	49 353
Rederiaktiebolaget Trans-Atlantic, Gothenburg	9	34 346
Aktiebolaget Svenska ostasiatiska kompaniet, Gothenburg	6	25 379
Ångfartygsaktiebolaget Thule, Gothenburg	11	16 345
Förnyade ångfartygsaktiebolaget Svenska Lloyd, Gothenburg	12	13 977
Rederiaktiebolaget Henckel, Malmö	9	13 756
Trelleborgs ångfartygs nya aktiebolag, Trälleborg	11	13 064
Ångfartygsaktiebolaget Svithiod, Gothenburg	8	9 812
Aktiebolaget Svenska Amerika-Mexiko-linien, Gothenburg	2	9 330

On the whole, it may be said of the Swedish shipping industry, that it has more and more succeeded in asserting itself in the rivalry for long-distance shipping, and that it has substantially succeeded in getting into its own hands Sweden's sea-trade with foreign countries — something which it had failed to do during a succession of years. For the promotion of the shipping industry, too, the State has tried to intervene, and also the Commerce and Shipping Committee, mentioned in another connection, has taken the initiative in reforms. Thus, in the years 1904 and 1905, the State formed a loan-fund of 10 million kronor for the assistance of the shipping industry, and more recently the State has granted subsidies in support of regular steam-ship lines (see below).

Shipping in General.

The entire shipping (home and foreign) of the Swedish ports amounted, in 1912, to 319 786 vessels entered and cleared, of a total of 51 802 208 tons. These figures for home shipping include all vessels of 10 tons and over, but not the local traffic in and about the respective harbours themselves. The above figures embrace 253 236 *steam ships*, of a tonnage of 48 124 620 tons, which corresponds to about nine-tenths of the sum total.[1]

As is well known, a great obstacle for Swedish shipping is the fact that, during a great part of the year, the harbours in the more northerly parts of the country are *ice-bound*. In South Sweden, on the other hand, it may be said that, generally speaking, the shipping is open practically all the year round. A comparison with earlier times, however, shows that the time during which shipping is held up by ice has, on the whole, grown shorter. This is chiefly due to the increased use of steam ships and the building of stronger vessels, which, here and there, are specially intended for winter traffic. The most important towns have provided themselves with special *ice-breakers*.

Some information with regard to Sweden's *ports* and *docks*, her *canals* and *fairways*, is given in special sections in the following pages.

[1] The figures are given as the sum of those given in the following pages. According to another method of calculation, the entire shipping, in 1912, is represented by 309 652 vessels with a total of 54 000 020 tons.

Shipping between Sweden and Foreign Countries.

The extent of Swedish foreign shipping, that is to say, the number and tonnage of vessels leaving Sweden for foreign ports, or arriving in Sweden from foreign ports, is indicated for the period elapsed since 1875 in Table 114. The average tonnage of such vessels entered and cleared during the years 1876—80 amounts to 6·43 million tons. In 1912 a tonnage of 25·51 million tons had been reached.

On the whole, the foreign shipping with Swedish ports is quite exceptionally extensive in comparison with the population. The average for the years 1906—10 amounted to nearly 400 tons for every hundred of the population.

Of all the countries in Europe, only Denmark, Holland, and Norway can present higher figures than these; even Great Britain and Ireland stop short at 300 tons for every hundred of the population. If we bear in mind, besides, that the *home-shipping* in Sweden is more extensive than in the countries just named as surpassing us in foreign shipping, the final result will be, probably, that the total shipping of the Swedish ports is, in proportion to the population, more lively than in any other country in Europe. The cause of this circumstance is that the goods that Sweden handles are, on the whole, of a very *bulky* nature. This is the case, too, even with the imports, of which fossil coal is the chief; but above all it is the case with the exports, of which, as is well known, the bulk consists of timber, minerals, and metals.

The result of this circumstance is that Sweden stands in a position of far greater international importance in respect to the tonnage she keeps employed than in respect to her actual commerce. According to Kiæer's investigations, it is probable that, at the present time, no article of the world's commerce requires so great a ship-tonnage for its carriage as timber does; and it is, of course, Sweden that is the greatest seller of timber throughout the world. Even in the coal-trade, Sweden plays an im-

TABLE 114. *Shipping between Sweden and Foreign Countries.*

Annually	Vessels entered		Vessels cleared		Total	
	Number	Tonnage	Number	Tonnage	Number	Tonnage
1876—80	21 919	3 196 448	21 472	3 231 885	**43 391**	**6 428 333**
1881—85	27 611	4 226 782	26 182	4 204 253	**53 793**	**8 431 035**
1886—90	28 640	4 934 938	27 012	4 933 878	**55 652**	**9 868 816**
1891—95	30 241	5 931 836	29 485	5 970 121	**59 726**	**11 901 957**
1896—00	34 140	7 781 894	34 179	7 793 822	**68 319**	**15 575 716**
1901—05	35 958	8 896 728	36 036	8 888 616	**71 994**	**17 785 344**
1906—10	35 164	10 132 689	35 246	10 141 969	**70 410**	**20 274 658**
1911	36 241	11 634 258	36 318	11 756 389	**72 559**	**23 390 647**
1912	38 057	12 681 250	38 584	12 830 640	**76 641**	**25 511 890**

Regular Swedish Transoceanic Lines, 1914.

America-Mexico Line.

Lines of the Rederiaktiebolaget Nordstjernan (Johnson Line).

South Africa Line.

East Asia and India Lines.

Australia and Java-Australia Lines.

TABLE 115. *Vessels entered from and cleared for Foreign Countries.*

Annually	Swedish vessels		Foreign vessels		Tonnage in thousands			
					Steam ships		Sailing vessels	
	Number	Tonnage	Number	Tonnage	Swedish	Foreign	Swedish	Foreign
1876—80 . . .	19 565	2 271 437	23 826	4 156 896	1 056	1 545	1 215	2 612
1881—85 . . .	25 953	3 036 018	27 840	5 395 017	1 726	3 027	1 310	2 368
1886—90 . . .	25 149	3 454 269	30 503	6 414 547	2 206	4 616	1 248	1 799
1891—95 . . .	28 623	4 011 511	31 103	7 890 446	2 678	6 316	1 334	1 574
1896—00 . . .	34 860	5 805 671	33 459	9 770 045	4 356	8 471	1 449	1 299
1901—05 . . .	39 443	8 177 307	32 551	9 608 037	6 742	8 439	1 435	1 169
1906—10 . . .	36 747	10 183 876	33 663	10 090 782	8 965	9 179	1 219	912
1911	35 825	11 633 878	36 734	11 756 769	10 605	10 843	1 029	913
1912	37 475	12 370 227	39 166	13 141 663	11 362	12 217	1 008	924

portant part. Of all the customers of England only Germany, France, and Italy buy more coal than Sweden. If we bear this in mind, it ought to be clear that, when it comes to the conclusion of commercial and maritime treaties, Sweden holds considerably higher trumps — owing to her important position in the shipping world — than might be expected from her comparatively insignificant position in the matter of commerce pure and simple.

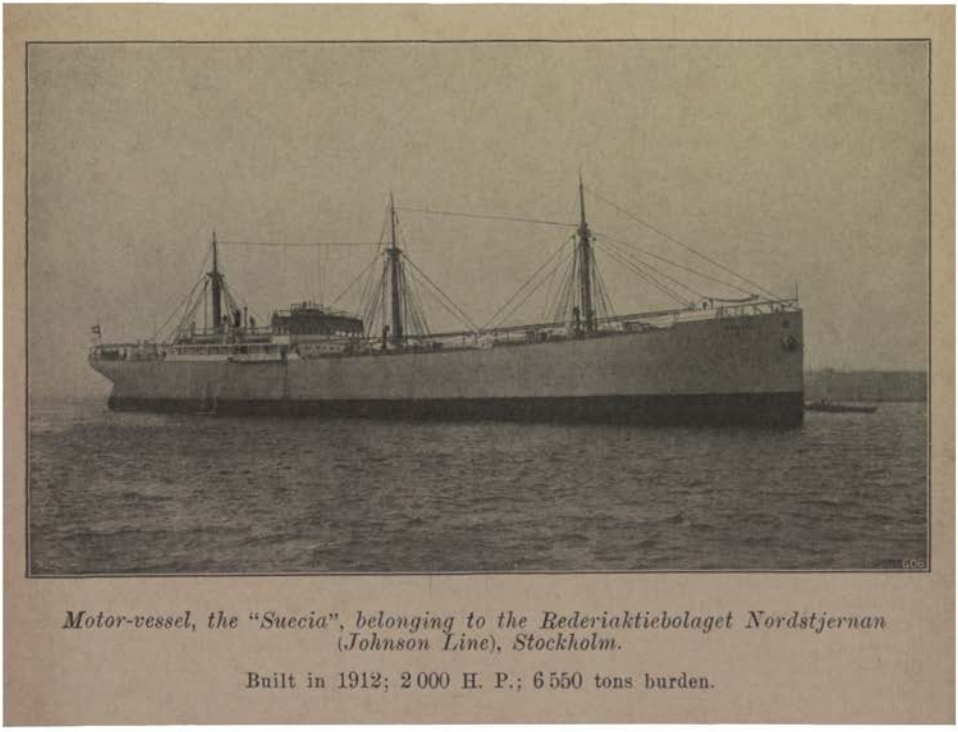
TABLE 116. *Foreign Shipping for 1912, arranged under Nations.*[1]

Nationality	Steam ships, in thousand tons					Sailing vessels, in thousand tons				
	Entered		Cleared		Total	Entered		Cleared		Total
	Laden	In ballast	Laden	In ballast		Laden	In ballast	Laden	In ballast	
Swedish	3 840	1 827	4 237	1 458	**11 362**	238	253	470	48	**1 009**
Norwegian . . .	478	395	759	154	**1 786**	32	77	92	12	**212**
Finnish	49	248	65	294	**656**	46	18	37	27	**128**
Russian	11	13	21	8	**53**	10	3	10	3	**26**
Danish	360	1 932	834	1 417	**4 543**	63	82	125	18	**288**
German	1 012	566	1 447	115	**3 140**	58	48	104	6	**216**
Dutch	22	196	215	7	**440**	15	6	19	3	**43**
Belgian.	6	5	9	—	**20**	—	1	1	—	**2**
English	469	243	574	172	**1 458**		3	3	—	**6**
French	7	8	13	1	**29**	—	—	—	—	—
Spanish	16	—	7	9	**32**	—	—	—	—	—
Italian	5	—	—	5	**10**	1	—	—	1	**2**
Austrian	3	7	15	3	**28**	—	—	—	—	—
Argentine . . .	—	2	2	2	**6**	—	—	—	—	—
Canadian	—	3	3	—	**6**		—	—	—	—
Siamese	—	5	5	—	**10**	—	—	—	—	—
Total	**6 278**	**5 450**	**8 206**	**3 645**	**23 579**	**462**	**491**	**861**	**118**	**1 932**

[1] By "ships in ballast" is to be understood such ships as have cargoes amounting to less than one-tenth of the registered capacity. Hence the description applies to most passenger boats.

TABLE 117. *Shipping Communications with Foreign Countries in 1912.*

To or from	Laden vessels thousand tons			Vessels in ballast thousand tons			Total thousand tons		
	Swedish	Other	Total	Swedish	Other	Total	Swedish	Other	Total
Norway	197	66	**263**	166	168	**334**	363	234	**597**
Denmark	737	794	**1 531**	1 689	3 525	**5 214**	2 426	4 319	**6 745**
Finland	56	99	**155**	157	589	**746**	213	688	**901**
Great Brit. and Irel.	3 249	1 794	**5 043**	496	348	**844**	3 745	2 142	**5 887**
Holland	599	426	**1 025**	159	296	**455**	758	722	**1 480**
Belgium	194	79	**273**	12	34	**46**	206	113	**319**
Germ. Emp.	2 936	2 721	**5 657**	698	906	**1 604**	3 634	3 627	**7 261**
France	292	248	**540**	12	18	**30**	304	266	**570**
Russia	232	111	**343**	180	191	**371**	412	302	**714**
Other Countries	292	685	**977**	17	43	**60**	309	728	**1 037**
Total	**8 784**	**7 023**	**15 807**	**3 586**	**6 118**	**9 704**	**12 370**	**13 141**	**25 511**



Motor-vessel, the "Suecia", belonging to the Rederiaktiebolaget Nordstjernan (Johnson Line), Stockholm.

Built in 1912; 2 000 H. P.; 6 550 tons burden.

According to **nationality** the shipping is distributed as shown in Tables 115—117. On an average, during the years 1876—80, vessels with a tonnage of altogether 2·27 million tons flew the Swedish flag; in 1912, the figure had advanced to 12·37 millon tons. During the same period the tonnage of foreign vessels had grown from 4·16 million tons to 13·14 million. Expressed as a percentage of the sum total, the figure for Swedish vessels during the first-named period reached 35 %, and, for the year 1912, nearly 50 %, which shows a considerable advance.

As is to be seen from the table, this change for the better has only been notable during the last decade, in connection with the above-mentioned advance of the mercantile marine. Even at the end of the 18th century the Swedish tonnage comprised only 37 %. Of the foreign vessels, it is the Danish that have long held a preponderating position as regards international shipping communications. At the end of the decade 1891—1900, the traffic between Denmark and Sweden was maintained by Danish vessels to the extent of about 80 %, while the share of Sweden amounted to only 15 %. By the readjustment of the Öresund traffic this state of things has now been changed, so that the share falling to Danish vessels is put at 61 %, and that falling to Swedish vessels at 36 %, in the case of the communications between the two countries.

A still more predominating position is held by foreign vessels in the shipping with Finland, the Swedish share amounting to only 24 %. As regards the communications with Russia, the Swedish tonnage has, during recent years, acquired a greater and increasing influence, in connection with the establishment of regular lines. Of the vessels cleared for Russia and entered from Russia the Swedish now comprise 58 %, whilst the corresponding figure at the end of the decade 1891—1900 was 28 %.

The share in the Swedish shipping of the *Norwegian* vessels has shrunk from 34 % in 1870 to 8 % in 1912. On the other hand, the proportion of

TABLE 118. *Foreign Shipping in 1912 according to Custom-House Districts.*[1]

Custom-house district	Tons	Custom-house district	Tons	Custom-house district	Tons
Luleå	1 421 760	Kristianstad .	169 252	Malmö[2] . . .	4 071 460
Gävle	1 023 138	Oskarshamn .	161 126	Gothenburg. .	3 760 178
Sundsvall . .	698 412	Karlshamn . .	150 200	Hälsingborg[3] .	2 761 986
Härnösand . .	464 951	Karlskrona . .	135 582	Landskrona .	347 162
Söderhamn . .	303 188	Ystad	114 875	Lysekil . . .	345 859
Umeå	195 232	Sölvesborg . .	74 193	Strömstad . .	319 919
Hudiksvall . .	187 628	Västervik . .	66 455	Halmstad . .	308 485
Skellefteå . .	172 189	Ronneby . . .	47 195	Uddevalla . .	95 898
Haparanda . .	135 938	Västerås . . .	29 838	Varberg . . .	83 155
Örnsköldsvik .	116 172	Simrishamn. .	27 505	Karlstad . . .	54 769
Piteå	67 769	Södertälje . .	24 949	Falkenberg . .	31 112
		Söderköping .	16 363	Marstrand . .	30 914
Norrland . .	**4 786 377**	Uppsala . . .	1 604	Lidköping . .	3 804
		Eskilstuna . .	353		
Trälleborg . .	3 173 850	Vadstena . . .	218	*Västkusten* .	**12 214 701**
Stockholm . .	2 077 670	Jönköping . .	—		
Nyköping . .	1 163 289	Linköping . .	—	*Total*	**25 511 890**
Visby	402 329	Örebro	—		
Norrköping . .	393 702	*Ostkusten* . .	**8 510 812**		
Kalmar . . .	280 264				

[1] Sum of the tonnage for vessels entered and cleared (foreign trade). A vessel that has visited several ports on the same voyage is only counted once, namely for the port where it has loaded or discharged the greatest amount of cargo. — [2] To or from Denmark 3 145 839 tons; other countries 925 621 tons. — [3] To or from Denmark 2 278 063 tons; other countries 483 923 tons.

German ships has increased from 3·5 % to 13·2 % during the same interval. With regard to the *English* tonnage, great changes are to be observed. In the year 1870, 14 % of our shipping was in English hands; in the year 1890, over 20 %; in the year 1898, it had declined to 12 %, and in the year 1912 it had further declined to 5·7 %.

Table 117 shows how the shipping facilities are distributed among the different countries, while Table 118 shows the extent of the foreign shipping maintained in the different parts of the country.

The number of **direct Swedish lines** to foreign countries has considerably increased during recent years, and almost invariably it is the Swedish shipping that has benefited.

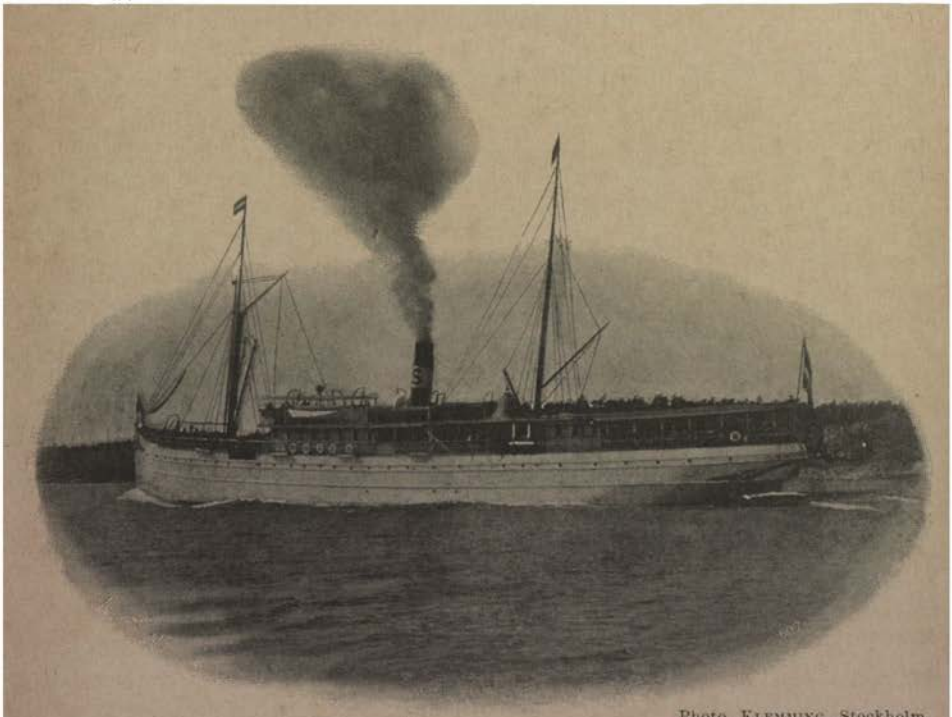


Photo. KLEMMING, Stockholm.

Steamer the "Gauthiod", the Stockholms Rederiaktiebolag Svea, Stockholm

The regular traffic with Finland is still maintained by Finnish boats, and similarly the Danish boats have a sort of monopoly of the steam-ferry service maintained between Hälsingborg and Hälsingör since 1891. On the other hand, the steam-ferry service which was set up in 1895 between Malmö and Copenhagen is carried on by Swedish and Danish companies conjointly.

The so-called "Continental Route" between Trälleborg and the harbour of Sassnitz, on the island of Rügen, which was started in 1897, has, since 1909, been organized as a ferry-service, taking through carriages between

Stockholm and Christiania and both Berlin and Hamburg. In accordance with an arrangement entered into between the respective countries, Swedish and German vessels run alternately on the route, which has become more and more frequented on account of its convenience, as the crossing occupies a short 4 hours, and the whole journey from Stockholm to Berlin takes only 22 hours.

The lines running to Russia, Germany, England, France, and other European countries, organized by Swedish shipping companies, have also developed in extension and importance. Since 1908, the state has subsidised a steam-boat line running between Stockholm and Riga, and at the same time arrangements have been made for connected and co-operative traffic on the Russian and Swedish Railways.

But of far greater importance, especially for Swedish export communications, are assuredly, the trans-atlantic steam-boat lines (cf. the accompanying map).

In 1903, the South Africa Trading Company of Stockholm, in connection with a Danish line, inaugurated a traffic with South Africa and East India. In the next year, facilities were arranged for traffic with S. Africa by a Gothenburg firm, too, — the so-called Swedish South Africa Line — which has since extended operations to Australia.

In 1904, the so-called Johnson Line (Rederiaktiebolaget Nordstjernan), of Stockholm began its services to La Plata; and since it began to receive state assistance in 1906, it has considerably developed (cf. map).

In 1907 was founded the Swedish East Asia Company of Gothenburg. This company maintains a traffic with East Asia in combination with foreign lines, and has, since 1907, been in receipt of state assistance.

There are, besides, similar lines to the Levant and Mexico, and in 1912 was opened a Scandinavian line to North America.

Swedish Vessels engaged in Foreign Shipping.

In the foregoing paragraphs it has been mentioned that, of the total tonnage of vessels entered and cleared in 1912 which maintained the traffic between Sweden and other countries — which amounted to 25 511 890 tons — altogether 12 370 227 tons was carried in *Swedish bottoms.*

That is *one* side of the activity of the vessels of the Swedish mercantile marine engaged in foreign shipping. The *other* side consists naturally of the voyages which Swedish vessels made between foreign country and foreign country — which voyages thus do not touch Sweden, and which are therefore not reckoned in under "The Foreign Shipping of Sweden".

As regards the part Swedish vessels play in **Shipping on Sweden,** this has already been dealt with in the foregoing section, both as regards the vessels' number and burthen, and as regards their most important countries of departure and destination. The above-cited information, gathered through the custom-houses, practically agrees with certain information returned from the shipping companies in the matter of their respective vessels' foreign voyages, in that,

TABLE 119. *Swedish Vessels employed in Foreign Shipping.*

Annually	Total of vessels entered and cleared		Total tonnage in thousand tons				Gross freightage earned in thousand kronor		
	Number	Tonnage	Laden	In ballast	Steam ships	Sailing vessels	Total amount	Between Sweden and abroad	Between foreign countries
1876—80 .	22 256	4 472 951	3 238	1 235	1 997	2 476	**35 514**	18 965	16 549
1881—85 .	25 917	5 242 730	3 928	1 315	2 778	2 465	**33 916**	19 652	14 264
1886—90 .	28 942	6 701 704	4 864	1 838	4 393	2 309	**33 428**	20 877	12 551
1891—95 .	30 786	7 779 571	5 473	2 307	5 546	2 234	**32 520**	21 993	10 527
1896—00 .	36 385	10 635 624	7 293	3 342	8 529	2 106	**47 321**	34 180	13 141
1901—05 .	40 086	16 005 855	10 871	5 135	14 068	1 938	**54 550**	37 421	17 129
1906—10 .	44 827	24 407 033	16 876	7 531	22 807	1 600	**75 383**	46 403	28 980
1911 . . .	48 815	28 613 564	20 091	8 523	27 215	1 399	**94 973**	55 242	39 731
1912 . . .	48 505	29 436 116	20 986	8 450	28 052	1 384	**106 285**	65 878	40 407

according to the companies' returns, the voyages of Swedish vessels between Sweden and foreign countries in 1912 should have given a total of 11 952 663 tons. It is of further interest to calculate the amount of the gross freightage earned on such voyages. According to the shipping companies' returns, the gross freightage earned by their vessels (calculated on arrival) amounted to 65 878 000 kronor in 1912. Of this total 29 335 000 kronor was derived from voyages to and from Great Britain and Ireland, 9 959 000 kronor from voyages to and from Germany, 4 813 000 kronor from the intercourse with France, 2 956 000 from that with Denmark, 4 945 000 from that with Holland, 2 438 000 from that with Belgium, and so on. Voyages to other continents than Europe produced only 6 333 000 kronor altogether.

The shipping companies also render returns of the freights carried by Swedish ships **between foreign country and foreign country,** and, according to these returns for the year 1912, the number of Swedish vessels arriving at one foreign port from another amounted to 10 758, with a tonnage of 8 773 575 tons, and there were about the same number of sailings. The total of the gross freightages earned on voyages between foreign ports amounted to 40 407 000 kronor.

A survey of the Swedish mercantile marines' employment on foreign shipping during a succession of years is given in Table 119, but in this connection it is to be noticed that the returns for different periods are not fully comparable, as they emanate from various sources, the data during earlier periods having been supplied by the consuls. However, the table indicates a gradual increase, especially during recent years.

Home Shipping.

Even if, during a succession of years, the foreign shipping of Sweden has exhibited weak points, to eradicate which serious attempts have been made only during the last decade, yet it can be said that the home shipping has long been organized to absolute perfection. The extremely lively communications between the different parts of the country have been maintained by several hundreds of steamers, and. for the local traffic between the numerous islands of our extensive archipelago, — as also for the

fishing industry — peculiar types of Swedish boats have developed, of which several may deserve mention here.

The Swedish **coastal steamers** early developed to a real type, which are as different from those of other countries as, e. g. the river steamers which have become a speciality for America.

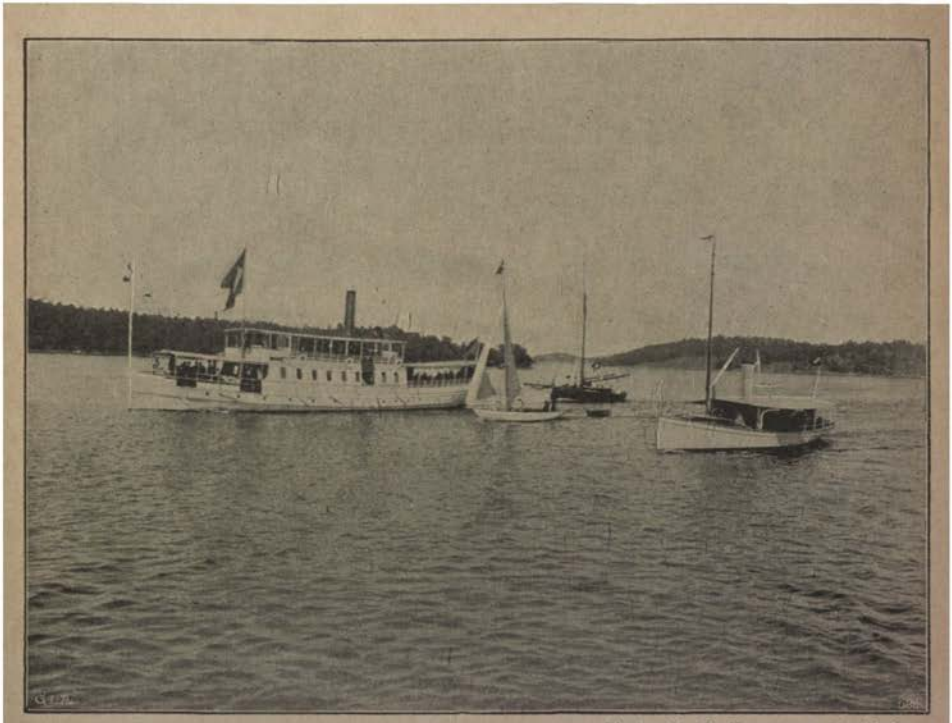


Photo. Fr. G. Klemming, Stockholm.

In the Stockholm Archipelago (Skärgård).

The Swedish coastal steamer is generally of medium size, about 60 meters in length. In appearance it is extremely elegant and almost resembles a pleasure yacht; it is kept extremely well, being painted, washed, and cleaned on every possible occasion. The fitting-up affords every comfort: the saloons are cosy, carpeted, well-lighted, and well-ventilated; the cabins are furnished with the most comfortable reclining places, broad and with soft upholstering (with scarcely ever two berths placed one above the other, as is so often the case in vessels of other countries). The attendants are exclusively women, and the catering, which is at the same time excellent and cheap, is as a rule mangaged by women. This perfection of comfort and ease in everything, combined with the pleasure of passing through the most splendid scenery, without any rolling and consequently without any sea-sickness, make the trips on Swedish island- and canal-steamers really pleasurable, a circumstance that has, in recent years, received the attention of tourists from foreign countries.

Among the **various types of Swedish sailing-boats,** the Koster boat, the Roslag sloop, and the Blekinge punt are the most noteworthy.

The Koster boat, so called after the Koster islands off the coast of Bohuslän, exhibits a happy combination of the qualities of a good and safe fishing boat, which, in case of need, can accommodate a considerable cargo, and those of a good sailer, which can successfully brave the notorious gales of the Skagerrak. The Koster boat is decked, particularly strongly built, and is provided with two sails, fore-sail and main-sail. This type is generally employed in the pilot-service.

The Roslag sloop, which can be traced back to the seventeenth century, is quite open and is provided with one large sail fixed to a boom — somewhat after the fashion of the mizzen-sail of a schooner — and also with a fore-sail. The construction of the boat, which derives its origin from the celebrated naval architect Chapman, is particularly elegant, though its lines are full. This type derives its name from Roslagen, or the tract immediately north of Stockholm on the coast.

The Blekinge punt, as the name indicates, is found chiefly in Blekinge. This type of boat is capacious and easy to row, it is a good tacker and easily handled, besides which it runs exceedingly well before the wind. It is also used for fishing in the open sea, in which case it has a single, very large square-sail; otherwise it has, besides a main-sail, at least a fore-sail.

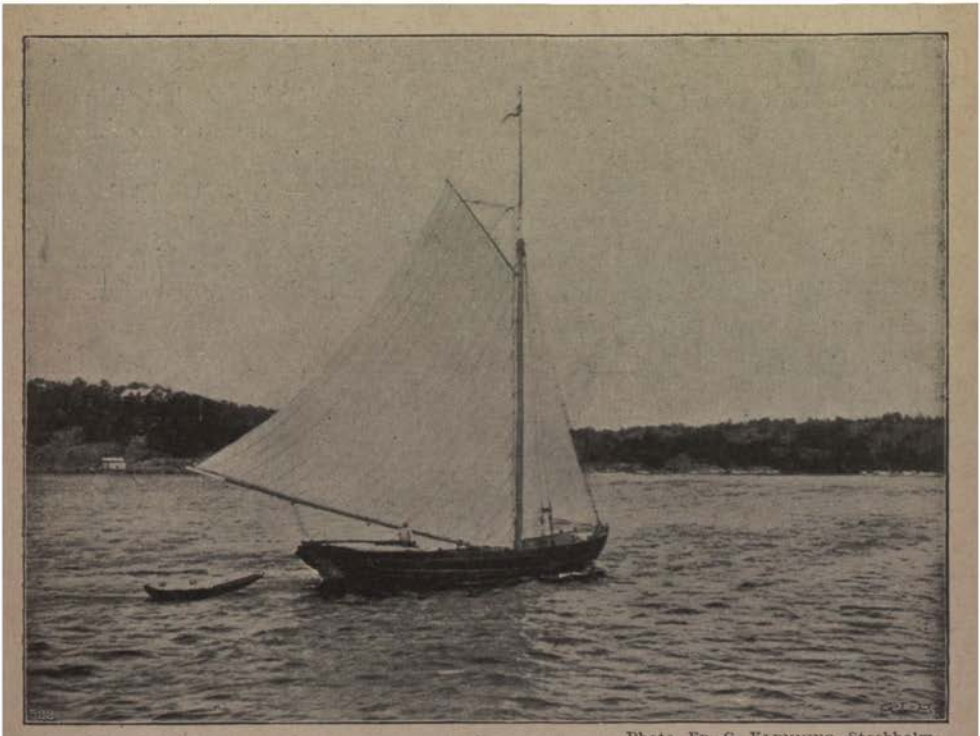


Photo. Fr. G. Klemming, Stockholm.

Roslag Sloop.

The entire **Home Shipping** in Sweden in 1912 — apart from vessels of less than 10 tons and excluding traffic within and about the respective harbours — comprised 243 145 vessels entered and cleared, with a total tonnage of 26 290 318 tons. Of this total 206 041 were steam-ships with a

tonnage of 24 545 081 tons, the steam-ships thus comprising 85 % in point of numbers and no less than 93 % in point of tonnage.

With regard to the traffic on the *canals*, some information is given in a special paragraph below.

It may be pointed out that in most countries the home shipping is a privilege reserved to *native* vessels; but in Sweden, in certain cases, foreign vessels have the right to carry on so-called coastal traffic.

Canals and Waterways.

In Sweden, a country munificiently endowed with lakes and rivers, *natural* watercourses have always been of great importance. It was along the waterways the cultivation of the land began and settlements were built, as in early times they were practically the only means of communication available during the seasons of the year when the absence of snow rendered sledge traffic impossible. This is still the case over large stretches of the northern provinces, where the rowingboat and the »rapids boat» *(forsbåt)* still play an important role.

It was therefore quite in the natural course of things that from an early date efforts were directed towards improving and connecting the natural watercourses by the construction of artificial **canals** and **waterways.** The term canal (which renders the Swedish *kanal)* will be used in the sequel to signify an entirely or partially artificial waterway equipped with one or more locks, whereas the term waterway, (which renders the Swedish *farled*), designates either a *natural* or in some cases an artificial watercourse *without locks.*

As early as at the beginning of the 16th century Gustavus Vasa, the Great Economist, was thoroughly alive to the importance of waterways for the development of the land, and designed several schemes to that end, schemes which the troubled conditions of the time prevented him from carrying into effect. One of those had the object of rendering Sweden independent from the powerful Hansa League and the Öresund tolls by arranging an inland waterway between the Baltic and the Kattegat. All the sons of Gustavus Vasa who succeeded him on the throne, devoted their attention to waterways. However, it was reserved for the youngest of them, Charles IX, actually to set on foot projects for canal construction. It was he too that gave the first impulse to the ambitious scheme for water communication through out Sweden which was drawn up by his son Gustavus Adolphus II and Axel Oxenstierna, the Great Chancellor, and which they as far as depended on them were in a fair way to carry into effect.

This Charles IX, amongst other projects, constructed a canal equipped with wooden locks between Lake Mälaren and Lake Hjälmaren from the Torshälla Falls to Hyndevad. This canal, which was in course of construction from 1596 to 1610, was called the *Hjälmare Canal,* and was the first of its kind in Sweden. However, it soon fell to pieces, and not more than thirty years had elapsed ere there was a new Hjälmare Canal completed, this time situated between the little river Arboga and Lake Hjälmaren, and running in pretty much the same direction as the present canal. This canal too was rebuilt several times. It was in 1830,

SWEDEN
1 : 8 500 000
0 100 200
km
Cercle polaire
Arctic circle
Norra polarkreis
Polarkreis
ATLANT. OCEAN
NORGE
FINLAND
Bottniska viken
Golfe de Botnie
Gulf of Bothnia
Bottnischer Busen
ÖSTERSJÖN
MER BALTIQUE
BALTIC SEA
OSTSEE
Kattegatt
DANMARK
KRISTIANIA
Kolmekaise
Sarektjäkko
Sulitälma
Dundret
Gällivare
Nasafjället
Bornavan
Haparanda
Luleå
Umeå
Åreskutan
Storsjön
Syltoppen
Östersund
Härnösand
Sundsvall
Ljungan
Städjan
Ljusnan
Söderhamn
Siljan
Gävle
Falun
Dalälven
Uppsala
Västerås
Örebro
Hjälmaren
Mälaren
STOCKHOLM
Karlstad
Åmål
Nyköping
Norrköping
Gottska Sandön
Skagerack
Uddevalla
Orust
Trollhättan
Göteborg
Jönköping
Taborg
Visby
Gottland
Halmstad
Växjö
Kalmar
Öland
Karlskrona
Kristianstad
Malmö
Lagan
Öresund
Hälsingborg
Torne träsk
Muonio älv
Lainio älv
Torne älv
Luossavara
Kirunavara
Kalix älv
Råne älv
Lule älv
Pite älv
Skellefte älv
Vindelälven
Ume älv
Gide älv
Ångermanälven
Faxeälven
Indalsälven
Ljusnan
Klarälven
Vättern
Vänern
Emån
Nissan
Viskan
Åtran
Göta älv
Tjörn
Slätbaken
Kalmarsund
Kalmarsund
Canals and Waterways.
1912.
Watercommunications with locks.
Watercommunications without locks.
Watercommunications for small boats.
12 Est de Greenw.
16
East of Greenw.
20
22
Östl. v. Greenw.
106
123483
Gen. Stab. Lit. Anst. Stockholm

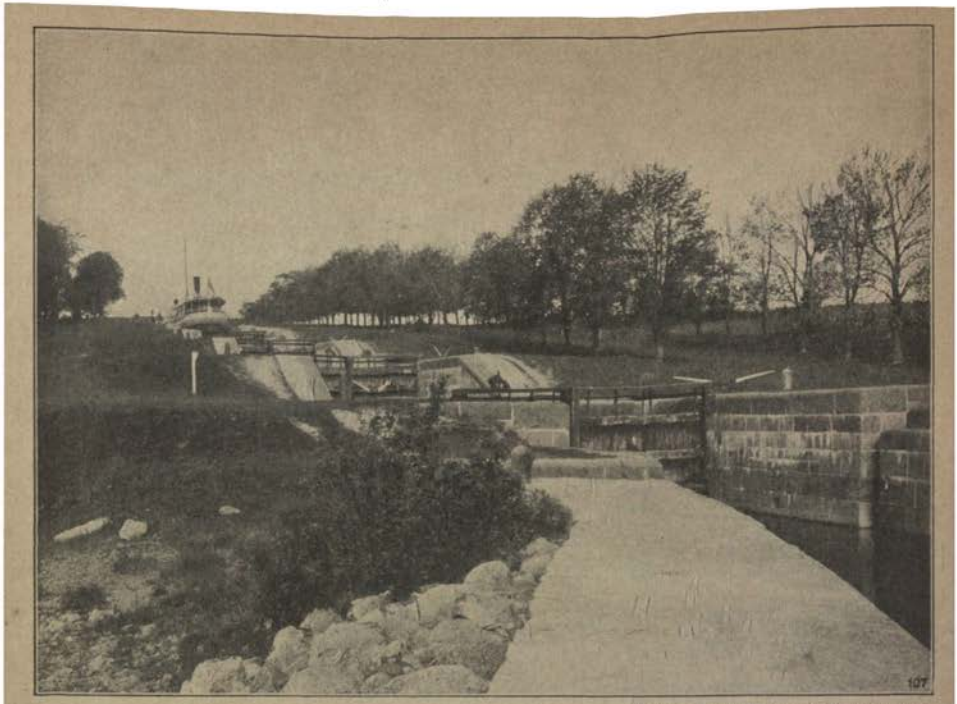


Photo. ALFRED SJÖBERG, Karlsborg.

The Göta Canal, the Berg Locks.

under the hands of the engineer Edström, finally put into what is virtually its precent condition.

One of the oldest canal works in Sweden, the *Stockholm lock,* was constructed as far back as 1639—42, but was rebuilt by Kristoffer Polhem in 1744—53. The present lock was completed in 1850 under the superintendence of Nils Ericson.

The *Strömsholm Canal* was started in 1776, and its first section, between Västanfors and Ramnäs, was opened in 1782. But it was not completed, by being carried down to Lake Mälaren at Strömsholm, until 1795. During the years from 1842 to 1860 it was rebuilt and assumed its present form. The once busy traffic to and from the mining districts has in recent times declined considerably owing to the severe competition of the railways. The small size of the canal is a great handicap.

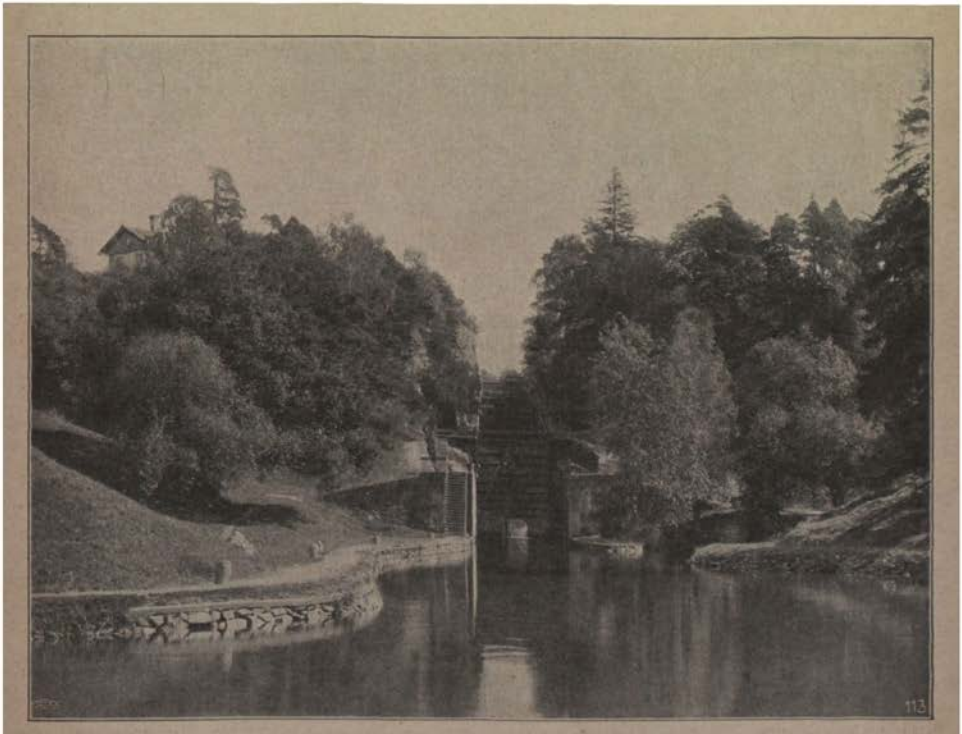
The *Trollhätte Canal,*[1] which passes all the falls in the Göta älv,[2] was actually opened for traffic in 1800. The works took seven years and were superintended by Nordevall, a most eminent engineer of the time and the designer of the project. Many fruitless attempts had previously been made to construct a navigable communication between Lake Vänern and the Kattegat. As early as in 1607, Charles IX had a lockage constructed at the lowest waterfall, the Lilla Edet Falls, and started on the trench, called "Karls Grav" which, greatly enlarged, still connects Lake Vänern with the reach of the Göta älv above Trollhättan. Kristoffer Polhem, the renowned engineer, concluded at Lund in 1718 veritable contract with Charles XII "to make a shipping route between Stockholm, Gothenburg, and Norrköping", and the works were even

[1] Named after the falls of Trollhättan (The Goblins Cap). — [2] Älv = river (älven = the river).

immediately commenced at the Göta älv. Owing to the Kings death that same year, the project though was abandoned. In the eighteenth century repeated attempts were made to carry out the enterprise with the aid of the State, and at Trollhättan traces of the works for this canal are still visible; in the first place Polhem's Lock, which affords abundant testimony to the genius and daring imagination of the projector. The canal which was completed in 1800 was executed by a private company, which however, was aided and favoured in many respects by the State. In similar way most of the great canal projects during the first half of the nineteenth century were carried into execution. The Göta Canal between Lake Vänern and the Baltic was completed in 1832. As it had been given greater lock dimensions than the Trollhätte Canal, claims were naturally advanced that the latter should be rebuilt to the same measurements as the Göta Canal. These proposals were even carried into effect in 1838—1844 by a new company which replaced the old one. The works were executed under the superintendence of Nils Ericson, famous both as a canal and as a railway engineer. The canal, thus rebuilt, is still in use as even the flight of locks at Trollhättan, remaining from the old canal continually utilizes after more than hundred years. At present the Trollhätte Canal is being subjected to a drastic reconstruction (see below).

Another old canal, still in use, is the *Södertälje Canal*, which was constructed under the superintendence of Nordevall from 1806 to 1819.

The *Göta Canal* from Söderköping to Motala and from Karlsborg to Sjötorp on Lake Vänern was in process of construction from 1809 to 1832. It owed its existence chiefly to the vigorous efforts of Baltzar von Platen, who devoted all his energy to this part of Sweden's "blue ribbon". The enterprise, magni-



The oldest Flight of Locks at Trollhättan.

ficent in itself, assumes enhanced lustre from the consideration that at this time the resources of the country had been seriously depleted by the Finnish war and the loss of Finland. It is true that the canal never acquired the great importance originally assigned to it as a transit between the seas. Nevertheless the benefit conferred by this waterway, eked out by the Trollhätte Canal, must not be underestimated. Besides serving the local traffic, it facilitated the cheap carriage of goods between the extensive upland country along the shores of the big lakes, and the coasts of the nearest seas.

Other important canals are the *Säffle Canal*, constructed in 1835—37 and rebuilt in 1866—69, which places the lakesystem of the Byälven in communication with Lake Vänern and the Kattegat; the *Dalsland Canal*, affording easy access from the lakes Stora Le and Lelången to Lake Vänern at Köpmannabro, and the *Kinda Canal*, connecting the Göta Canal with Lake Åsunden, the former built in 1865—69, the latter in 1865—71.

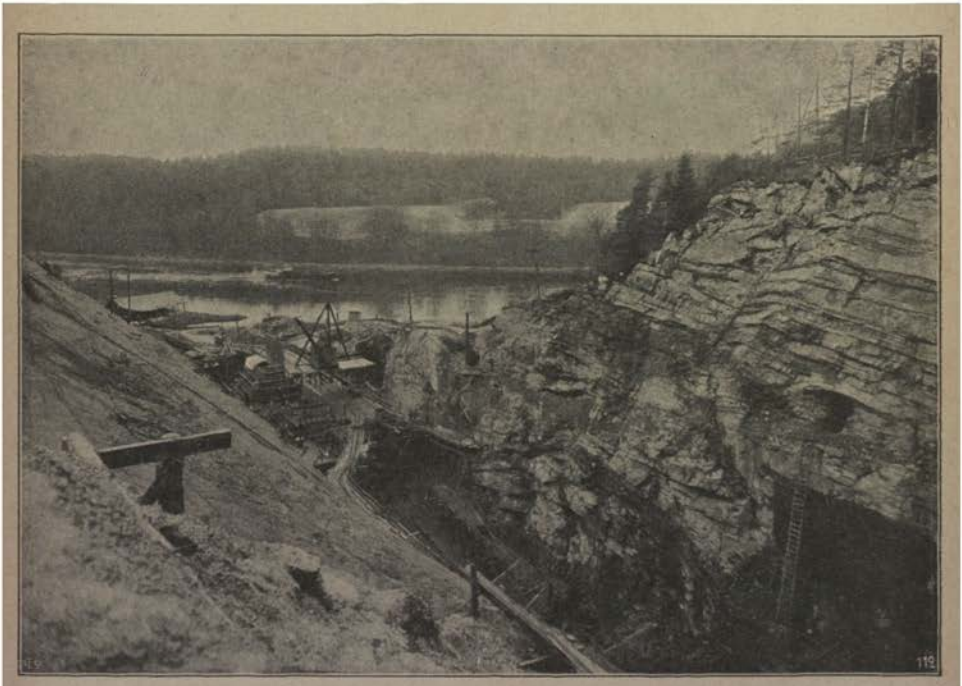
During the first half of the nineteenth century the *technique of canal construction* was carried to a high pitch of perfection. This is abundantly testified by the many canal works then achieved and which are in use to this very day. But as the century waned to its close, the canal building was almost entirely abandoned. The railways had now begun their triumphal march even in Sweden, and the canals, which were handicapped with regard to cheap and speedy freights by their small dimensions adapted to the needs of earlier times, were regarded by many as mere historical curiosities. This was also the case in other countries. But in the enormous development of traffic which has taken place in recent times, the water routes once more came into favour. It was realised that both means of transport had their *raison d'être* alongside of one another, nay that in the case of large traffic, a natural division of labour ensued, the bulky, heavy and less urgent goods falling to the water routes, which conveyed them at the cheapest price. This radical change of view as to the importance of waterways has in several civilized countries given rise to magnificent new canal projects, and to the improvement of older canals.

People have begun to realize this in Sweden too. An index of how opinion in this respect has veered is the investigation which Government in 1896, at the request of official bodies and private persons interested in the question instructed the Väg- och Vattenbyggnadsstyrelsen[1] to set on foot with respect to a new improved waterway between Lake Vänern and the Kattegat. Another case in point is the Government Bill which, at the instance of the Väg- och Vattenbyggnadsstyrelsen, was brought before the Riksdag providing for among others an investigation of new canal routes with large dimensions from Lake Vänern via Lake Vättern to the Baltic and from Lake Vänern via Lake Hjälmaren to Lake Mälaren. It is true that this latter Bill was thrown out by the Riksdag, on the ground of the investigations then in progress for the canal from Lake Vänern to the Kattegat, but in the other hand, these latter investigations were fraught with far-reaching consequences.

In 1902 the Väg- och Vattenbyggnadsstyrelsen submitted a petition, based on investigations and proposals by Laurell, the then major in the of Royal Engineering Corps, requesting that an improved *canal and waterway between Vänersborg and Gothenburg*, with a depth of 6 meters at low water, might be carried into execution. This proposal having been submitted to official bodies and interested persons, for their consideration, was finally in 1906 forwarded to the Royal Board of the Trollhätte Canal and Water Works, constituted in 1905. The fact was that the Government (in order to be in a position satisfactorily to solve the question

[1] A Royal Board that controls and partly executes the construction of highways, private railways, canals, harbours etc.

of how best to utilize the water power of the Trollhätte Falls and also the question of the waterway), had in 1904 purchased all the property of the New Trollhätte Canal Company and had placed it under the administration of the Board just mentioned. The investigations of the Board were brought to a termination in 1908 and issued in a scheme for the reconstruction of the waterway for vessels with a draught of 4 meters, but with locks and other artificial works for vessels with a draught of 5 meters. Government having immediately appointed a larger commission to consider the proposal, and the latter having given its approval, Government Bill, drawn up in conformity with that proposal was brought before the Riksdag in 1909. This Bill made its passage into law, and thus this vital question after years of investigations and parleyings to and fro, was finally solved.



The new Flight of Locks at Trollhättan; in course of construction 1912.

The works of construction, which have been estimated to 22·8 million kronor were immediately started under the superintendence of the Royal Board of Waterfalls, and are estimated to be completed in 1916. The locks will be given the following dimensions: $90 \times 13{\cdot}7 \times 5{\cdot}5$ meters, whereas the present locks in the Trollhätte and Göta Canals measure $32 \times 7{\cdot}13 \times 2{\cdot}97$ meters.

Another canal question has come into prominence of late. As the rebuilding to a double track line of the Södra Stambanan (the South Trunk Railway) advanced to Södertälje, it showed necessary to satisfactorily arrange the point of crossing the *Södertälje Canal*. The Riksdag of 1912 then decided on the purchase of the same canal from the owning company and placed it under the administration of the Board of Waterfalls. The Board of Waterfalls has afterwards by command of the Government worked out a project on the rebuilding of the canal, in which was recommended a size allowing until further

the passage of up to 5·5 m. deapgoing vessels, but providing for larger lock dimensions. The Riksdag furthermore has assigned a certain amount for the dredging of the south part of the canal to the corresponding depht, with the main reason though to obtain necessary fill for the railway-works mentioned above. This decision is also indicative of the interest in water communication which has been perceptible of late. That an improvement, on modern lines, of the water communication between that big inland lake and the Baltic is of paramount importance, and is a question which can no longer be put by the board is attested not only by the purchase just alluded to, and by the keen interest displayed in the project and its probable consequences by the towns on Lake Mälaren and the tradesmen and industrial classes in the country round it, but also by the plans which the City of Stockholm has long been nursing to provide a canal for large vessels, south of Stockholm via Lake Hammarby and the bay of Årsta. This question hangs together with the proposals for shorter approaches to Stockholm, as, for instance, through the Moranedet, through Sågsjön (Baggensfjärden to Halvkakssundet), through Ålstäket, and other routes.

Other signs pointing in the same direction are the works just completed for the extension of the Dalsland Canal from Stora Le to Lake Östen and the project, now under consideration, for the construction of the Nyköping canal, which is intended to place the Södermanland lakes, Båven, Lidsjön, Yngaren, Långhalsen and others, in communication with the Baltic. Further have of late several towns and cities submitted to the Government on investigations with regard to the rebuilding of the Göta Canal into a watercourse answering to the claims of the time. Other less ambitious canal projects are in progress of execution, or under discussion.

Photo. NILS G. AHLIN, Håverud.

The Dalsland Canal, the Aqueduct at Håverud.

Photo. K. Sidenbladh, J:r.

The Södertälje Canal.

Waterways. Sweden has countless waterways, if one includes under that term all the smaller water routes which Nature has created and which art has here and there improved.

No exhaustive data are procurable with regard to the waterways of Sweden. On the other hand, the Väg- och Vattenbyggnadsstyrelsen has compiled statistics with regard to the waterways that have been constructed or improved with *State* aid. It is true that this excludes such important waterways as, for instance, the entrance to Gothenburg, which is maintained by that City, and the approaches to Stockholm from the sea (except as regard the channel at Kodjupet near Vaxholm). Nevertheless an extract from this said compilation eked out by the latest information obtainable from the same source, has been inserted here, as being of no small interest for the subject in hand (Table 120).

One of the groups of waterways included in the table consists of those which do not communicate with sea. We note in this respect chiefly the busily plied waterway communicating with the Fryken lakes in Värmland.

Another group is formed by waterways, abridging the distance between waters previously connected with each other, and which are chiefly intended to provide facilities for the coast shipping to pass within the cover of the islands, avoiding the risks of the open sea. Such are, for instance, the Väddö waterway in the Uppland skärgård,[1] and the Albrektssund waterway in the Marstrand skärgård. The Väddö waterway, which connects Ortalaviken with Bagghusfjärden has a very ancient history. It was rebuilt to a depth of 3·1 meters in 1898—1904.

The Albrektssund waterway affords facilities for sailing within the shelter of the islands almost the whole way from Gothenburg to Strömstad. Formerly

[1] »Skärgård» = a coastline splittered in numerous islands.

	Year of Construction of present Canal	Costs of Construction in kronor	Length in kilometers		Depth meters	Width at Bottom in meters	Locks			
			Total	Artificial			Number	Length in meters	Width in meters	Depth in meters
A. Canals.										
Trollhätte Canal	1838—1844	5 393 181	81·5	8·0	3·0	11·9	16	32·0	7·1	3·0
Göta Canal	1809—1832	15 690 000	189·7	86·2	3·0	14·3	58	32·0	7·1	3·0
Södertälje Canal	1806—1819	834 750	5·1	2·1	3·6	11·9	1	38·6	8·6	3·6
Stockholm Lock	1845—1850	1 106 265	0·1	0·1	3·6	9·5	1	45·0[1]	9·5	3·6
Hjälmare Canal	1819—1830	1 500 000	64·1	8·5	2·1	10·7	9	32·1	7·1	2·1
Eskilstuna Upper and Lower	(1855—1860)	285 400	10·7	1·8	2·5	7·7	2	35·6	7·1 / 7·8	2·5
Strömsholm Canal	1842—1860	4 257 260	100·5	14·4	minimum 1·5	5·3 and 9·5	31	20·1	5·3	1·5
Dalsland Canal and Silarna Cross-Canal	1865—1869	1 449 265	253·9	7·9	1·9	4·6	28	20·8	4·2	1·8
Stora Le-Öster	1910—	ca. 370 000	21·5	2·6	2·0	4·6	2	22·6	4·2	1·8
Snäcke Canal	1872—1874	43 861	17·4	0·1	2·1	4·2	1	20·8	4·2	2·1
Säffle Canal and Byälven waterway	1866—1870	371 000	90·9	12·8	2·1	7·7	1	32·0	7·8	3·0
Kinda Canal	1865—1871	1 293 822	80·2	26·9	minimum 1·5	5·3	15	25·5	4·9	1·5
Åker Canal	1883—1886	165 888	10·7	3·7	2·1	8·9	1	27·6	7·4	2·1
Örebro Canal	1886—1890	539 025	1·5	2·0	2·2	minimum 8·9	1	32·1	7·1	2·2
Others[2]	.	810 361	165·8	7·5	.	.	11	.	.	.
Total		**34 110 078**	**1 093·6**	**184·6**			**178**			

[1] By the use of a pontoon in front of the lock-chamber the available length of the lock-chamber can be increased to 58·6 meters. If necessary the length can be brought up to 70·5 meters, by employing both pontons, that on the Mälaren and that on the Saltsjön side. — [2] Six in number.

B. Waterways.	Year of construction Latest period	Cost of construction in kronor	Length in kilometers		Depth in meters l. w, l.	Width at Bottom in meters
			total	artificial		
1. *Not Communicating with Sea.*						
Waterway along the Fryken Lakes	1852	12 330	74·8	0·6	1·48	—
» Tisnaren and Fjällnaren Lakes	1910	145 900	9·4	2·4	1·50	6·00
Others	·	229 636	94·7	9·6	·	·
Total		**387 866**	**178·9**	**12·6**		
2. *Abridging Distance between Waters previously Connected.*						
Väddö Waterway	1898—1904	1 382 334	14·9	7·0	3·10	10·00
Albrektssund Waterway	1905—1909	225 046	3·2	2·3	4·00	20·00
Waterway through Kalmar Sound	1898—1904	530 000	5·9	1·3	6·00	80·00
Others	·	1 555 275	·	·	·	·
Total		**3 692 655**				
3. *Communicating with Sea.*						
Waterway to Luleå	1888—1892	411 275	8·0	1·6	7·50	30·00
» » Gävle	1891—1899	441 295	10·7	1·0	6·50	45·00
» » Uppsala	1841—1857	122 984	54·6	8·0	2·38	13·36
» » Enköping	1833—1836	25 500	3·8	3·8	2·38	2·97
» » Köping	1855—1858	84 450	3·3	3·3	2·97	11·88
» Arboga River	1855—1860	109 770	16·0	4·8	2·82	17·81
» to Norrköping	1850—1856	161 916	11·6	11·6	4·31	20·78
» » Uddevalla	1874—1875	208 134	4·2	0·3	5·94	23·75
» through Brandalsund	1887—1888	10 735	0·2	0·2	6·00	30·00
Others	·	896 052	249·6	37·4	·	·
Total		**2 472 111**	**362·0**	**72·0**		

TABLE 121. *Traffic in Canals and Waterways in 1912.*

Name	Vessels, Barges, and Floats passing Canal	Steamers		Sailingboats of more than 10 tons		Smaller sailing-boats	Barges	Timber Floats	Canal Dues in Kronor
		Number	Tons	Number	Tons				
A. Canals.									
Dalsland	12 713	5 820	166 776	403	15 066	1 249	1 605	3 636	110 122·88
Eskilstuna, lower	1 532	907	48 000	14	440	393	218	—	16 163·02
Eskilstuna, upper	794	636	39 005	2	82	—	156	—	6 205·88
Filipstads bergslag	12	12	[1] .	—	—	—	—	—	22·00
Forshaga and Karlstad	351	124	1 240	—	—	—	159	68	2 093·96
Göta	5 289	2 032	197 605	1 312	73 834	424	1 469	52	241 106·94
Gothenburg Lock	3 928	—	—	—	—	[2] 90	3 838	—	4 005·25
Nya Hjälmare	1 320	482	44 873	6	207	243	589	—	30 764·40
Kinda	2 986	1 665	57 759	16	626	28	1 021	256	25 633·33
Knappfors	289	135	552	—	—	—	154	—	556·00
Räppe-Tofta-Åsasjön	754	423	[1] .	—	—	—	325	6	2 687·88
Snäcke	418	212	8 056	52	1 976	109	—	45	2 238·31
Stockholm Lock	31 020	12 061	412 108	2 039	92 572	612	15 499	787	91 995·78
Strömsholm	2 996	673	10 358	44	1 341	—	1 909	370	27 260·73
Säffle	2 158	1 431	130 967	493	18 250	—	234	—	58 731·11
Södertälje	7 996	2 976	291 749	1 178	63 256	854	2 297	691	73 415·71
Tisken-Runn Lock	1 930	1 662	[1] .	—	—	—	268	—	414·69
Trollhätte	11 281	8 947	796 209	823	50 077	—	1 464	—	655 847·25
Åker	949	528	21 453	178	2 989	—	47	196	3 322·46
Örebro	1 902	1 523	68 071	58	2 179	—	321	—	16 175·96
Total	**90 618**	**42 249**	**2 294 781**	**6 618**	**322 895**	**4 002**	**31 573**	**6 107**	**1 368 763·54**
B. Waterways.									
Albrektssund	3 313	1 208	[1] .	2	270	2 082	21	—	2 325·18
Almarestäket	2 775	1 037	69 167	1 236	61 523	—	—	502	3 115·80
Djurgårdsbrunn	5 586	5 225	[1] .	291	4 121	1	69	—	324·00
Gränsö	5 903	4 264	10 316	11	161	1 612	14	2	1 886·90
Härnösand	1 642	1 311	45 634	62	909	125	58	86	3 215·95
Härnestad waterway a. "Sydöstra kanalen"	[3] —	—	—	—	—	—	—	—	—
Karlberg	11 164	9 135	98	158	7 026	20	1 851	—	1 543·00
Mälaren—Alby and Tullinge lakes	262	109	2 676	16	628	8	126	3	327·51
Nättraby	5 753	5 111	[1] .	188	4 535	454	—	—	648·48
Stegeholm	478	293	60 993	95	8 926	21	65	4	3 167·33
Strömma	622	622	[1] .	—	—	—	—	—	828·00
Strömsholm at Västervik	1 095	375	2 535	257	7 668	279	182	—	1 142·97
Tjuvholmssund	1 556	1 189	864 069	179	14 715	—	133	55	114 356·48
Tynderö	1 062	988	47 253	—	—	—	57	17	181·00
Väddö	2 704	1 306	34 311	467	22 974	61	466	20	7 615·15
Älkistan	1 160	792	[1] .	—	—	—	179	—	402·10
Örsundsbro—Högby	10	—	—	10	308	—	—	—	23·55
Total	**45 085**	**32 965**	**1 137 052**	**2 972**	**133 764**	**4 002**	**3 221**	**689**	**141 103·40**

[1] Number of tons not stated. — [2] Including even vessels without charge. — [3] No vessels have plied the canal during the year.

it was only 1·78 meters deep, but it has now been excavated to a depth of 4 meters.

Finally, there is a group of waterways comprising what may be called as "inland" water routes, though all of them communicate with the sea. Take, for instance, the fairways from the sea to certain important ports, such as Luleå (depth 7·5 meters), notable for its great export of ore, Gävle (6·5 meters), Norrköping (4·31 meters), Uddevalla (5·94 meters). Then there is the Brandalsund (depth 6 meters), which serves as a link of communication for the traffic to and from Södertälje and Lake Mälaren through Södertälje Canal. Nor must we forget in conclusion the water routes of this class which, ramifing from Lake Mälaren to Uppsala, Enköping, Köping, Arboga, place these towns in communication with the sea.

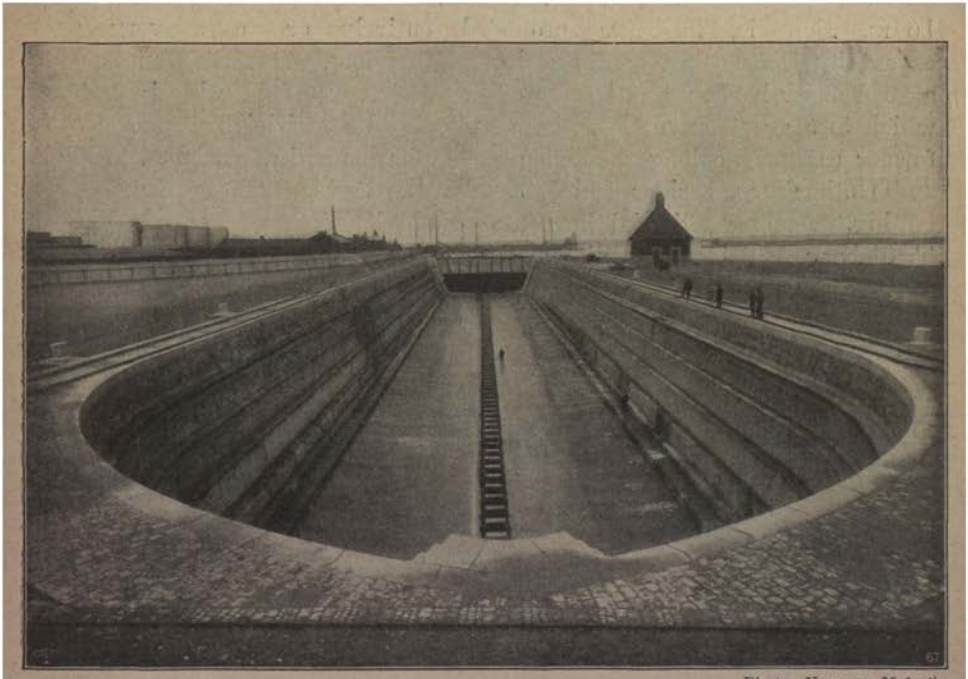


Photo. NELSON, Malmö.

The New Dry Dock at Malmö.

It is to be hoped that the revived interest in the long-neglected water-routes which, to judge by numerous signs has at last been aroused in Sweden, and for which the works and projects touched upon in the foregoing are the symptoms, is destined to subsist, and that it will contribute its quota to the development and progress of Swedish enterprise and of Swedish industry.

The canals and waterways of Sweden, with the exception of the Trollhätte and Södertälje canals, which are administered by the Board of Waterfalls, are all under the supervision of the Väg- och Vattenbyggnadsstyrelsen. That department also administers the Väddö and Albrektssund waterways, which are State

property. The beacon and lighting arrangements are subject to the supervision of the Pilotage Board. However, there are certain private waterways which in this regard do not fall within the purview of the Pilotage Board.

Harbours and Dry Docks.

In virtue of the long line of the Swedish coast, the almost entire absence of tide, the existence of numberless firths and river-mouths penetrating deeply into the country, provided with good anchorages, and sheltered by nature from wind and wave, and also of a number of lakes connected by canals with the sea, Sweden has in proportion to her population, an extremely large number of *harbours*. Most of these are natural harbours, that is, harbours protected entirely or to a very great extent by the natural conformation of the land. But Sweden has also a good many harbours, and some of them of very considerable importance, which to a great extent have been protected by artificial means. To the former category belong the two greatest harbours in Sweden, Stockholm and Gothenburg, besides Luleå, Sundsvall, Gävle, Oxelösund, and Norrköping. Among artificial harbours should be reckoned Malmö, Kalmar, Trälleborg, Hälsingborg, Visby, Ystad, and Halmstad.

TABLE 122. *Important Harbours.*

Harbour	In 1910					At the end of 1910					
						Quays in use for general traffic for depth under mean water level					
						under 4 m		4 to 6 m		over 6 m	
	Total Construction Costs of Harbour[1] in mill. kr.	Ships entering or leaving		Dues for		Stone m	Wood m	Stone m	Wood m	Stone m	Wood m
		Number	Reg. Tons	Tonnage kr.	Freight kr.						
Stockholm	15·4	85 663	6 799 603	316 081	619 143	179	651	2 309	5 921	2 427	1 642
Gothenburg	11·9	16 809	4 510 108	384 243	470 124	3 775	232	1 864	—	1 249	—
Malmö	17·5	12 789	4 463 560	141 995	288 607	—	1 150	—	1 565	2 400	3 300
Luleå	1·9	2 493	1 698 604	81 551	14 895	—	—	—	732	540	—
Örnsköldsvik	0·9	1 738	534 244	27 909	19 338	—	200	267	435	—	—
Härnösand	0·6	6 572	726 582	22 730	23 548	100	340	330	565	—	180
Sundsvall	1·6	9 617	1 425 064	62 634	60 951	—	541	—	713	—	208
Hudiksvall	0·4	1 310	516 818	30 264	20 793	—	240	404	229	—	—
Söderhamn	2·0	4 397	774 144	56 679	49 655	60	4 050	—	620	564	—
Gävle	3·9	3 846	1 436 872	95 749	185 019	245	3 917	1 628	2 110	480	—
Oxelösund	1·9	2 834	1 417 803	[2]	[2]	335	117	150	—	497	—
Norrköping	3·4	4 265	1 016 574	75 279	184 014	—	—	2 806	738	—	—
Västervik	0·5	5 060	538 232	16 816	22 593	—	565	300	110	—	—
Oskarshamn	1·6	2 545	554 256	21 956	36 063	140	270	1 005	—	—	—
Kalmar	1·5	6 152	1 055 542	47 342	82 406	70	700	905	425	200	100
Karlskrona	1·8	2 408	537 568	34 091	35 145	150	165	155	675	—	340
Trälleborg	2·2	2 905	2 670 085	24 004	94 763	—	135	—	360	—	505
Landskrona	1·0	4 154	883 383	40 082	88 400	—	400	—	570	410	490
Hälsingborg	5·2	12 059	2 981 276	93 548	203 529	26	22	698	535	1 378	142
Halmstad	1·5	4 012	700 197	52 815	124 744	392	882	576	1 181	—	—

[1] In some cases: approximate value of harbour works. — [2] No harbour dues are paid.

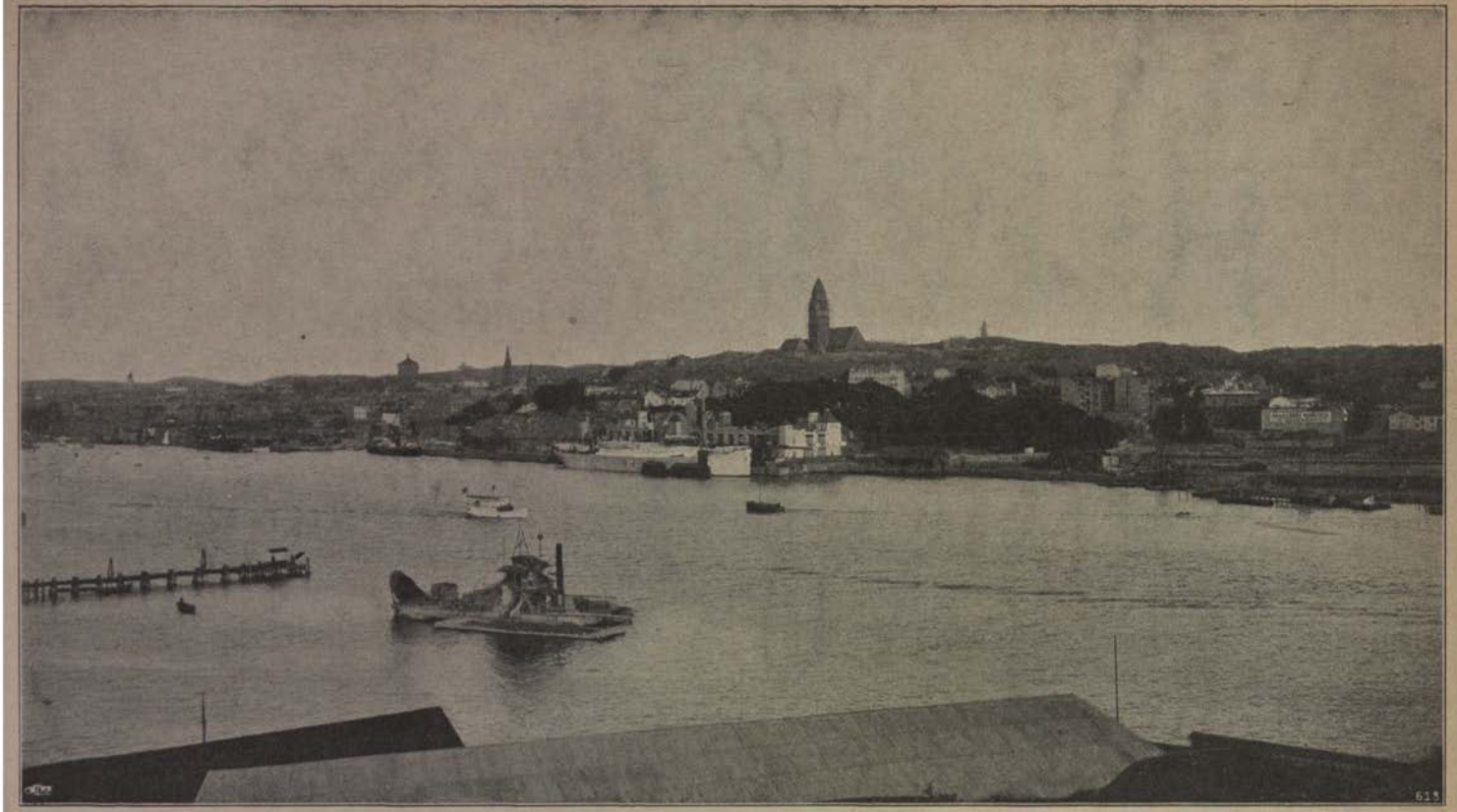


Photo. A. JONASON, Gothenburg.

Gothenburg Harbour (south bank of the Göta älv).

Owing to the rapid advance of shipping, harbour-works have especially during recent years undergone considerable development in point of technique. In several places expensive quays with warehouses and arrangements for loading and discharging, have been executed. — Sweden does not yet (1914) boast of any free-ports, but projects have been mooted for the establishment of a free-port at Stockholm, Gothenburg, Malmö, and elsewhere. Particulary great interest in the project has been evinced at the two latter towns, and at Gothenburg a large extension of the harbour which was resolved on in 1912 will in all probability be made a free-port.

The Statistics of the Board of Trade show that Sweden in 1910 had 260 harbours, that 331 064 ships of 10 tons and upwards entered or left those

TABLE 123. *Docks in 1912.*

Place	Proprietor of Dock	Depth at threshold (at mean water-level)	Width at entrance	Actual Dock's Width at bottom	Actual Dock's Width at water-line	Actual Dock's Length at bottom	Actual Dock's Length at water-line
		m	m	m	m	m	m
Stockholm:							
Galärvarvet	State (Navy)	6·97	16·7	16·6	22·4	125·0	129·0
Beckholmen	Grosshandelssocieteten	5·18	15·8	15.5	18·1 à 22·7	99·0	103·6
do.	Grosshandelssocieteten	3·96	10·6	10·5	11·9 à 17·0	98·0	100·5
Floating	Bergsunds mekaniska verkstads aktiebolag[1]	5·48	[1]	(16·8)	[1]	74·0	74·0
do.	Södra varvet[2]	4·50	9·0	9·0	9·0	31·0	31·0
Norrköping	Private	3·00	10·8	5·6	15·7	69·4	74·2
Söderköping	Göta kanalbolag	3·10	7·5	25·1	35·4	81·0	89·0
Motala	do.	3·00	7·2	22·1	27·1	98·9	101·4
Sjötorp	do.	3·00	7·3	23·0	35·0	67·6	70·0
Oskarshamn	Oskarshamns mekaniska verkstads och skeppsdockas aktiebolag[3]	4·66	14·8	16·5	21·0	105·0	105·0
do.	Oskarshamns mekaniska verkstads och skeppsdockas aktiebolag[3]			10·2	11·4	44·8	47·5
Karlskrona:							
Old	State (Navy)	5·37	13·7	17·1	24·0	68·7	68·7
No. 1	do.	5·91	14·1	15·4	20·2	55·6	66·2
» 2	do.	6·00	14·2	15·4	20·8	77·3	89·7
» 3	do.	6·05	14·2	15·1	21·3	58·6	67·4
» 4	do.	6·11	14·1	15·7	22·6	61·9	71·5
» 5	do.	6·11	14·1	15·7	22·6	61·9	71·3
Oscars II's	do.	7·53	20·8	20·8	25·5	119·0	125·0
Sölvesborg	Sölvesborgs skeppsvarv	4·80	12·0	16·5	19·5	84·9	86·4
Limhamn	Skånska cementaktiebolaget	1·35	7·2	7·2	11·0	42·0	50·0
Malmö: old	City	3·70	10·4	10·4	15·4	[5]72·0	[5]78·4
new	do.	7·25	[4] 20·0	21·7	27·1	[6]160·0	[6]163·0
Hälsingborg	do.	4·90	13·1	12·0	19·5	82·0	90·0
Gothenburg	Lindholmens mekaniska verkstads aktie-bolag	5·50	17·8	16·0	21·0	125·0	125·0
Trollhättan	State	4·50	10·8	10·0 à 30·0		74·5	75·0

[1] Floating Dock, lifting capacity 2 200 tons, L section. — [2] Floating Dock, lifting capacity 350 tons, U section. — [3] Gates common to both docks. — [4] At waterline, width at port opening 24·0 m. — [5] Lengths in normal cases 8 m less. — [6] Lengths in normal cases 4 m less.

harbours, and that the total tonnage of those ships was 52½ million register tons. In 235 of these harbours the tonnage dues aggregated 2 355 529 kronor, and in 79 of them the freight dues totalled 3 417 975 kronor.

The Table 122 gives more detailed data as to the harbours which in 1910 showed a tonnage of over 500 000 register tons.

There are dry *docks* for public use at Stockholm, Gothenburg, Malmö, Oskarshamn, Norrköping, and other places. Moreover Stockholm has one *naval* dock, and Karlskrona seven. The Table 123 shows *dimensions of docks,* etc.

There are large *slips* for vessels at Stockholm (Finnboda), Gävle (Gävle varv och verkstäder), Malmö (Kockums mekaniska verkstad), and Gothenburg (Lindholmens verkstad and Götaverken). These five slips (according to data received from their owners) can take vessels of:

79·3, 84, 84, 76 and 75 meters greatest length respectively, and about 1 500, 2 000, 1 300, 1 200, and 1 500 tons greatest dead-weight.

Pilots and Lighthouses. Life-Saving Institutions.

The pilot and lighthouse services and the life-saving institutions for those wrecked at sea constitute in Sweden one single department called *Lotsverket,* the Pilot Service. This department is subordinate to the *Lotsstyrelsen,* the Pilotage Board.

As early as the middle of 16th century there existed enactments prescribing that whosoever, after having undertaken to pilot a ship, ran her aground should forfeit his life, unless the accident had been due to heavy seas and violent storm. The *Pilot Service* as an institution dates back to the time of Charles XI. In 1655 the Crown pilots had assigned to them certain farms out of the Crown demesnes which were exempted from incumbrances, in return for which their owners were under obligation to serve as pilots on the ships of the Crown in precedence to all others. According as the navy was increased, the pilotage institution was expanded. In 1687 the *lotsdirektörsämbetet,* the Office of the Director of Pilots, was instituted. In 1774 was introduced "*lotspliktighet*", that is the obligation for vessels entering from the open sea to make use of a government pilot. Perch beacons *(prickar)* and other sea-marks were in use as long ago as the Middle Ages, but during the reign of Gustavus I the peasants dwelling in the *skärgård* (belt of skerries) were enjoined to beacon all reefs, shoals, and shallows both within and without the skerries with "broom beacons" (stakes surmounted with a broom). At the present time the approaches to ports and the waterways are beaconed thus: red-painted broom beacons *(kvastprickar)* on one side, and plain beacons *(slätprickar)* painted black and white on the other.

As regards *lighthouses,* it should be noted that the Kullen lighthouse in Skåne is the most ancient in Sweden, having been erected as early as 1560. However, it was not till after 1800 that the development of lighthouse arrangements has gone rapidly forward. The first lightship was stationed at Falsterborev in 1884.

The *Life-Saving Service* dates its origin from the close of the seventeenth century; it was then managed by private persons. It was not until 1855 that the first life-saving station supported by the State was erected, but since that time this service has gone forward pretty rapidly, until it reached its present stage of development.

A kind of nautical description of the Baltic was written as early as 1644 by *Johan Månsson,* a captain in the Admiralty, who also published a sort af maritime chart of that sea. An improved chart was published in 1694 by Captain *Gädda,* but it was not till 1737 that the first step was taken towards the institution of a nautical chart office. At the present time there are excellent charts of the coast of Sweden. An account of the Nautical Chart Office will be found in the section entitled: Official Cartography p. I, 226.

The Pilotage Board. The Pilotage Board, which is governed by regulations of the 13 December 1907, consists of a director-general and three members, one of whom is the head of the chancery, one the head of the pilot office, and the third superintendent lighthouse engineer and head of the corresponding office. — The permanent staff of the Board numbered in 1911 23 persons.

The Pilot Service. The present organization of the Pilot Service dates from 1881, with a few subsequent alterations introduced especially by the Royal Ordinance of the 30 September 1904. In this Ordinance it is enacted that the coasts of Sweden and adjacent waters shall be divided into 6 pilotage districts, namely *Övre Norra,* the Upper North district, comprising the coasts of the Norrbotten and Västerbotten läns; *Nedre Norra,* the Lower North district, embracing the coasts of the Västernorrland, Gävleborg, and Uppsala läns, and those of Stockholm län up to the north boundary of Väddö parish; *Mellersta,* the Midland District, including the coasts from the last-named boundary and down to the boundary between the parishes of Bälinge and Tystberga in Södermanland, Lake Mälaren and Lake Hjälmaren, and the island of Gottland; *Östra,* the East district, covering the coasts from the last-named boundary in Södermanland to the boundary between the parishes of Kristianopel and Torhamn in Blekinge as well as the island of Öland and Lake Vättern; *Södra,* the South district, comprehending the coasts from the last named frontier in Blekinge besides the Malmöhus and Kristianstad läns; *Västra,* the West district, embodying the coasts of the Halland, Göteborg och Bohus läns and Lake Vänern. Each district is superintended by a pilot captain *(lotskapten).* The pilot captains are, as a rule, selected either out of the corps of naval officers or from among the pilot lieutenants *(lotslöjtnant).* The pilot lieutenants are the pilot captains' right-hand men and deputies; one of them is assigned to each division, and in addition one to the island of Gottland. The lieutenants too are as a rule chosen out of the corps of naval officers or from the Naval Reserves.

The pilot personnel consists of *överlotsar,* senior pilots, at certain important stations, *lotsförmän,* head pilots, at other stations, and the requisite number of pilots rated as *mästerlotsar,* master pilots, *lotsar,* ordinary pilots, and *lotslärlingar,* articled pilots. The lighthouse personal is composed of *fyrmästare,* lighthouse keepers, *fyrvaktare,* lighthouse men, and *fyrbiträden,* assistant lighthouse men. The staff at the life-saving stations consists of *uppsyningsmän,* overseers, *båtstyrare,* steersmen. and *roddare,* rowers.

All who belong to the permanent pilotage staff are obliged in time of war or important preparations for war, when the King so commands, to serve in the Royal Navy. However, even in time of peace the pilot service manages the rather intricate coast signal service of the Navy. The Director-General of Pilotage and the personnel belonging to the pilotage divisions are subject to military law.

The Pilot Personnel. The pilot personnel should have a thorough knowledge of the waters in their district and of the shallows and reefs in their vicinity, even when no seamarks have been set up; it devolves upon them to set up beacons immediately after the ice has given way; to keep watch so as to ensure that vessels arriving from abroad shall only enter the officially sanctioned fairways and shall call at the custom-house; to render their services as pilots to the seafaring public, and so forth. The pilots are not in receipt of any fixed salary: their chief source of income consists of the pilot dues paid by the public. However, at pilot stations where there is little or nothing to be earned in this way, the personnel are as a rule in receipt of a salary, ranging from 60 to 1 200 kronor. The pilot dues at each pilot station are divided at the end of each month between the pilots, generally in equal shares called *lotslotter*. These shares vary greatly. Thus in 1911 the biggest share was 4 911 kronor, and the smallest merely 4 kronor. The big share fell to the pilots at Oxelösund, the tiny one to the personnel at a small station on the coast of Öland.

In the autumn of 1912 the Pilotage Board *(Lotsstyrelsen)* submitted to the Government a proposal for a revised scale of wages for the pilot and lighthouse personnel. This scheme contained several new elements. But, as it provided *inter alia* that the pilots should receive only 20 % of the pilotage dues, and that their chief income should consist of their fixed salary, it encountered stout opposition both from the shipping interest, who were alarmed lest under the new arrangement the pilots should lose interest in their work and consequently also their efficiency, and from the pilots themselves, who declared that it would be impossible to keep a wife and family under such miserable conditions.

The new scheme, which has been revised by a special committee, is to be laid before the Riksdag.[1]

The Lighthouse Personnel. The lighthouse personnel has to attend to the illumination of lighthouses: they must keep sea lights kindled from sunset to sunrise, as long as navigation within the range of the light is not impeded by solid ice; they have also to attend to fog-signalling. As to the smaller lighthouses stationed in the waters of the *skärgårds*, and which are only looked after once a week or more seldom being allowed to burn on day and night, special lighting seasons are prescribed. The

[1] Proposals have now been brought forward in the Riksdag for fixed scales of salary and 40 % of the pilot dues, but have not yet been parsed (October 1914).

TABLE 124. *Pilotage and Lighthouses in 1871 to 1911.*

Annually	Pilotings	Pilotage Dues	Pilot Service Expenditure[1]	Casualties at sea[2]	At the end of the period				
					Pilot Stations	Lighthouse Stations	Pilot Staff[3]	Lighthouse Staff	Value of Materiel[4]
	Number	Kronor	Kronor						Kronor
1871—80 . .	45 080	674 627	1 032 201	183	144	85	856	235	6 133 491
1881—90 . .	28 639	617 905	1 337 350	208	135	241	780	361	8 429 081
1891—00 . .	38 620	856 216	1 583 033	216	131	312	939	414	10 310 218
1901—05 . .	44 859	1 048 507	1 815 620	235	124	320	880	417	11 195 172
1906—10 . .	46 062	1 183 240	1 875 423	212	117	331	841	465	11 973 899
1911	47 393	1 258 720	1 796 062	203	117	347	842	448	12 059 595

[1] Inclusive of expenses for life-saving. — [2] On the coasts of Sweden. — [3] Subordinate officers and servants, inclusive of those servants (32 in 1911) who belong both to the pilot and the lighthouse service. — [4] Exclusive of the value of the boats belonging to the members of the staff personally.

lighthouse personnel are on the permanent establishment and are in receipt of fixed salaries.

The light-ships on the East coast of Sweden are stationed out early in the spring as the drift ice allows; they are withdrawn as soon as there is serious risk of their becoming ice-bound. On the South and West coast of Sweden, on the other hand, the lightships are sometimes allowed to remain moored at their stations the whole year round. — The value of the 22 lightships was estimated in 1911 at 2 215 879 kronor.

The personnel at the **Life Saving Stations** in 1911 numbered 165 hands, besides 19 belonging, properly speaking, to the pilot and lighthouse services. They are remunerated for each salvage operation.

The whole entire pilot service is supported solely out of the "lighthouse and beacon dues" *(fyr- och båkmedlen)*, that is, the dues paid by ships leaving the harbours for foreign ports, or entering them from abroad. These dues at present amount to 25 öre for every ton and for certain voyages according to the tonnage certificate *(mätbrev)*. In 1911 they yielded the total sum of 1 929 181 kronor.

The *waterways* in which official pilotage is prescribed are 2 200 in number, and the *sea-marks* total 4 759. — The number of vessels that foundered in 1911 with a Government pilot on board was 28, but only in five cases was the pilot sentenced by the maritime court as responsible for the accident. — As to the development of the pilot and lighthouse services since 1871, data are furnished by Table 124.

In the 16 *life-saving stations* in Sweden 7 lives were saved in 1911 and from the very start altogether 1 861 lives.

In addition to the State life-saving stations above referred to, a few other such stations have been established with the aid of voluntary contributions by a private society for the saving of lives at sea. However, since 1907, when it was started, that Society, for all its rather expensive paraphernalia, has only succeeded in saving three lives.

The Pilot Service supports entirely or partially no less than 27 *schools* in out-of-the-way stations, and in these schools instruction has been imparted to 222 children (1911).

Sweden has always been to the fore in the matter of lighthouse technique and *invention.* Thus the first *revolving light* that is known to have existed was erected at Marstrand, an island off the west coast of Sweden. Another Swedish invention was the *von Otter System* for illuminating with different intermittent lights certain sectors which contain shoals within their radius. Of Swedish origin is the *Lindberg System* of automatic rotators for producing intermittent light in smaller lighthouses, whereby continual superintendence can be dispensed with: this system is employed in inshore waterways almost all over the world. Finally a lamp for constant burning specially constructed for these lighthouses, with petroleum as an illuminant, was invented by a Swede.

In conclusion the reader's attention must be directed to the "*Aga*" lighthouses erected a few years ago, which have been rapidly disseminated throughout the whole world, and to which such importance has been attached that their inventor, the Swede *G. Dalén,* was in 1912 awarded the Nobel Prize for Physics. These lighthouses may be said to be almost ideal: they do not require any attendance, but burn automatically for a whole year. They are charged with acetone gas accumulators, which are changed every year. By means of an ingenious device, the "sun-valve" *(solventil),* they are extinguished at sunrise and lighted at sunset automatically. They can be adjusted to a different number of flashes of varying periods. These lighthouses are manufactured by the *Gasaccumulator Company* at Stockholm, which is said also to have large branch factories abroad.

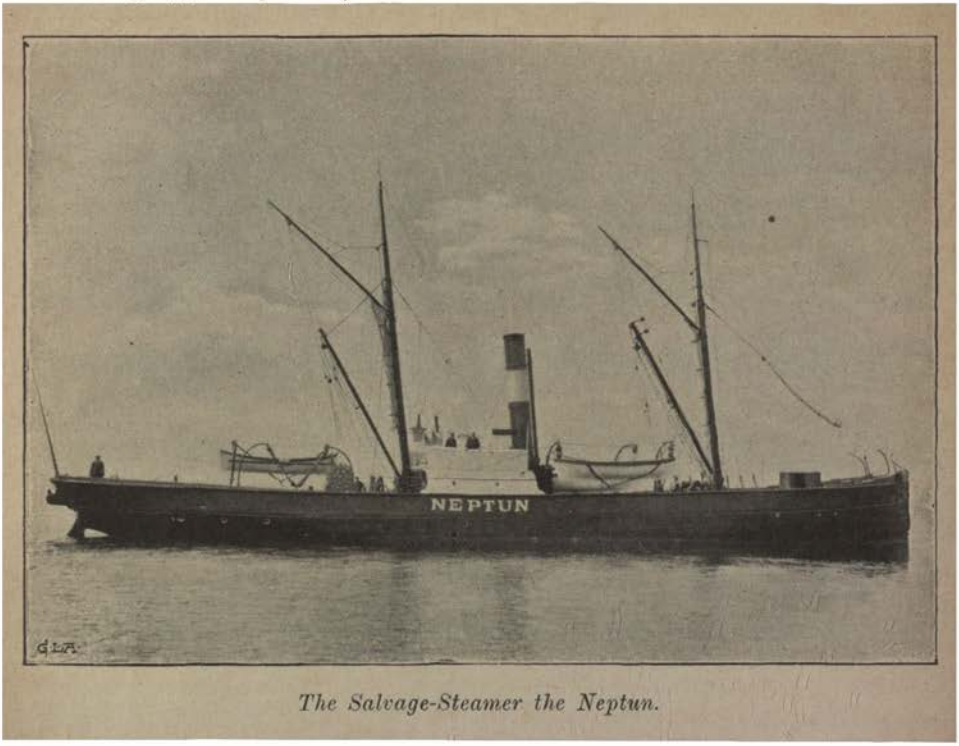
Salvage and Diving.

Diving operations for salving the cargoes of shipwrecked vessels are first recorded in Sweden in the latter part of the 17th century, when a foreigner, F. A. von Treuleben, received a Royal license to transact diving and salvage business. Subsequently (in 1692 and 1729) two diving companies, as they were called, were started, whose charters were renewed from time to time. These two companies succeeded in subsisting side by side down to 1802, when they were amalgamated into one. The amalgamated Company survived until 1831, though in the later years of its existence, it was shorn of certain of its privilegies. In the thirties attempts were once more made to set on foot a chartered company, and a charter for one was actually issued. However, diving operations soon passed into the hands of private speculators.

The credit for having organized salvage work in Sweden is due chiefly to Consul *E. Liljewalch,* who in 1869 founded the **Neptun** Salvage and Diving Company, famous all over the world. The operations of the Company are by no means confined to Sweden: they have been extended to many parts of Europe and Africa. The Neptun Company has moreover received offers of salvage business from America, although it has not been in a position to avail itself of them.

The chief *materiel* of the Company consists at present of 10 salvage steamers, 8 stationary centrifugal pumps, 18 portable steam pumps, 2 motor pumps actuated by electricity, 28 complete diving apparatus, 4 pontoons made of iron cylinders, 2 prismatic iron pontoons, 4 wooden pontoons, 1 800 fathoms of nine-inch steel cables, 200 fathoms of Galle's chain, 100 fathoms of chain-cable, 42

hydraulic jacks, lifting 100 tons each, and a number of sea-going hulks with steam cranes, sea-going barges with hoisting cranes, submarine rock-blasting and rock-boring apparatus, tackle, and so forth.



The Salvage-Steamer the Neptun.

Since its formation, the Company has salved 4 ironclads, 2 destroyers, 1 cruiser, 1 submarine, 1 torpedo-boat, and 1 371 steamships and sailing-ships, 4 dredgers, 1 lightship, and 1 366 cargoes, riggings, and other sundries. Altogether 7 008 successful salvage operations have been carried out, representing in value after the salvage, and in allowing for the damaged condition of the objects rescued, an aggregate of 181 423 000 kronor. Notable cases of wrecks raised by the Neptun Company are those of the Easington in 1889 near Constantinople, of the Coningsby, a British steamer, in 1890 near Cape Finisterre, of Eider, a German emigrant, in 1892 off the Isle of Whight (a brilliant achievement), of the Howe, a British ironclad, in 1893 off Ferrol, a world-renowned achievement which elicited from the British Admiralty the most lavish encomiums on the Company and its officials. The Company also achieved great notoriety by its raising of the Willysike, a British steamer, in 1898 off the Canary island, of the China, likewise a British steamer, in the same year off Perim in the Red Sea, of the Chile, a French steamer, in 1903 off Bordeaux, of the Cyclops, a British steamer, in 1910 in the Red Sea, and of the Minehaha in the same year off the Scilly islands. A remarkable instance of a wreck having been raised from a considerable depth is that of the steamer Bore, which in 1901 sank off Kapelskär north of Furusund at a depth of 35 meters, and in the teeth of enormous difficulties was brought up to the surface. Many other difficult cases of wreck-raising were successfully tackled by the Neptun Company, as for example that of a pontoon dock which in 1901 sank off Dar-es-Salem on the east coast of Africa, the British submarine A I which foundered in 1904

close to the Nab lightship, and the Swedish tugs, the Eol and the Styrbjörn, the former of which sank in 1908 and the latter in 1912. All these vessels were brought up from very respectable depths.

In recent years endeavours have been made in Sweden to work at greater depths than formerly, when 30 meters was the greatest depth to which a diver could descend. A remarkable invention for this purpose is the *Waller Tube*, an ingenious diving apparatus constructed in 1895 by the Swedish engineer P. A. Waller. It consists of a sheet-iron tube composed of several parts, expanded at the bottom into a working chamber somewhat wider than the rest of the tube; through this working chamber pass firstly, in a *vertical* direction, iron rods, movable up and down through hermetically closed apertures, and which can be turned in different positions from within the chamber; secondly, in a *horizontal* direction, instruments projecting through ball-bearings, which, from inside, through the wall of the chamber, can be pushed in and out, as well as turned and adjusted in different positions. At the bottom the vertical rods are fitted with hooks, so that they can be thrust down to grapple under the object to be raised; at their upper extremities they are furnished with chain-couplings which pass up to winches or cranes above the surface of the water. The working implements projecting through the wall are intended for emergency purposes, for which purpose there is an exterior semi-spherical opening, which can be closed hermetically or opened, according to requirements. It was with the Waller Tube that the Södra Sverige, a Swedish steamer (about 600 tons) which foundered in the Stockholm Skärgård in September 1895, was raised in the autumn of 1896 to May 1897 from a depth of from 55 to 56 meters, that is, double the greatest depth from which it had hitherto been accounted possible to raise a wreck.

Though primarily intended for wreck-raising at great depths, the Waller Tube is pretty sure to be enlisted in the service of deep-sea exploration. With that apparatus it is an easy matter for a diver to descend to a depth of two hundred meters or more, and to remain below for any length of time.

Navigation Schools.

The origin of the Swedish navigation schools dates from June 4th 1658, when a school for training mates was established at Stockholm by Royal Decree. Their present organization is based principally on Royal Decree of April 7th 1841, while at present the Royal Regulation of March 29th 1912 is in force. *Four schools,* comprising both a navigation and an engineers department, are established at Stockholm, Gothenburg, Malmö, and Härnösand, while *one school,* consisting of only a navigation department, is situated at Kalmar.

The navigation department includes classes for masters, mates and first skippers; the engineers department classes for first engineers (chief engineers), second and third engineers. The Supervisory Board for the schools — at present the Navy Board — is assisted by an inspector appointed by the Government for a period of three years. An expert is appointed by the Supervisory Board to conduct examinations and to assist in the execution of certain work in the engineers departments. A board consisting of five or seven members is appointed for each school by the local municipal Government for a period of three years. An expert is appointed by the

Supervisory Board to conduct examinations and to assist in the execution of certain work in the engineers departments. A board consisting of five or seven members is appointed for each school by the local town council; the director is appointed by the Government and the regular and extra teachers by the Supervisory Board. The provisions of the law regarding the right of civil servants to a pension apply to the pensioning of directors and regular teachers. The teaching staff is paid from State funds, but the school premises and dwellings for the directors are found by the respective communes. Other expenses are covered by State grants and by the pupils' fees, which vary from 8 to 30 kronor.

A course preparatory to passing the *navigation teacher's examination*, which is required of directors and regular teachers in the navigation department, is arranged every other year at Stockholm, at the beginning of September. The course comprises mathematics, physics, mechanics, theory of deviation, nautical meteorology, theoretical and practical astronomy, terrestrial and astronomical navigation. Regular teachers in the engineers department must have gone through the department for machine construction and mechanical technology of the Technical High School, or some other equivalent course.

Pupils in the mates class at the navigation school must have served on deck on a sailing vessel and steamer in a certain trade for 42 months, and pupils in the skippers class for 36 months. Pupils in the second engineers class must have served as assistant to the engineer on a steamship and as machine and boiler workman in a mechanical work for a total of 48 months, and pupils in the 3rd engineers class for 30 months. These pupils must pass an entrance examination in Swedish and arithmetic, while pupils in the mates class must also pass in algebra and geography. Pupils in the masters class must possess a mate's certificate, while pupils in the first engineers class must have obtained an engineer's certificate of the second class and have subsequently served for 24 months as engineer on a steamship in a certain trade. All pupils must possess a medical certificate that they have good hearing, while pupils in the navigation department must also possess a certificate that their sight is good and that they are not colour blind.

The instruction begins at the various schools, in the mates classes on the 1st and 15th of August and on the 1st of September, in the second engineers classes on the 1st and 15th of August, in the first engineers classes on the 1st and 15th of September, in the masters' classes on the 1st and 15th of September and on the 1st of October, in the skippers and 3rd engineers classes on the 7th of January.

The courses extend, in the mates class over about 9 months, in the masters and second engineers class 8 months, in the first engineers class 7 months, in the skippers and 3rd engineers class 3 months.

The instruction comprises, in the masters class: mathematics, physics, mechanics, navigation, shipbuilding, applied mechanics, seamanship, the Swedish and English languages, law, hygiene and bandaging; in the first engineers class: physics, mechanics, applied mechanics, machine drawing, electricity, the Swedish and English languages, hygiene and bandaging. In the other classes certain of these subjects are omitted.

The examinations are partly written and partly oral. Papers are set for the former by the inspector, with the assistance of the above-mentioned experts, as far as the first and second engineers classes are concerned. In order to obtain the right to undergo the oral examination all pupils must have passed

the written examination in mathematics, while pupils in the navigation department must also have passed in navigation, and pupils in the 1st and 2nd engineers class in physics and mechanics.

To obtain the right to command sailing vessels of a certain tonnage on inland waters and in the Baltic, there is, further, an examination at the navigation school for skippers of the second class. Persons taking this examination however do not receive instruction at the navigation school.

In the educational year 1911—12, when the regulations of June 6th 1890 were still in force, 160 candidates passed the masters examination, 184 the mates examination, 133 the chief engineers examination and 116 the engineers (second engineers) examination.

Maritime Legislation.

On June 12, 1667, a Swedish maritime law was passed, which, based on Dutch ordinances and subsequently supplemented by — amongst other things — certain sections of the regulations for merchant captains and sailors of March 30, 1748, as well as the insurance and damage ordinances of Oct. 2, 1750, was not entirely abrogated until two hundred years later. The maritime law then passed (Feb. 23, 1864) was founded upon the main principles of the law it was to replace, but was supplemented according to the requirements of the time by profiting by more recent legislation in foreign countries. This was succeeded, *on June 12, 1891*, by the maritime law now in force, which came into operation from the year 1892 inclusive, and which was drafted after collaboration with Norwegian and Danish delegates, and this less on account of the necessity for amendments in the law of 1864, than owing to an endeavour to secure uniformity in the maritime legislation of the Scandinavian countries.

Swedish maritime legislation, except for the part exlusively or mainly belonging to civil law and included in the maritime law, has furthermore found expression in a multitude of statutes passed by the Government.

A vessel is considered to be Swedish, either when at least two-thirds of it are owned by Swedish subjects, or when it belongs to a joint-stock company whose board sits in Sweden and is composed of shareholders who are Swedish subjects.

Every Swedish man or woman has *the right to own ships* for both home and foreign shipping. When several persons are owners of a ship, a *principal owner* must always be selected among them, who must always be a Swedish citizen and domiciled in Sweden.

A *shipowner* is personally responsible with all his property for the liabilities he, personally or through some other person, assumes in respect to the vessel, as well as for the claims of the crew in virtue of the hiring-agreements and contracts of service which the master of the vessel has entered into. For all other claims the owner is responsible only and solely to the extent of the vessel and cargo. When there are several owners of a vessel, each one is personally responsible only in proportion to his share in the vessel.

Of all Swedish vessels intended for the merchant service or the conveyance of passengers and having a tonnage of 20 register tons or more, a *register* is kept. This registration is centralized at the Board of Trade. After registration has been effected a certificate of nationality and registration is issued, which, together with a muster-roll, are the papers a Swedish vessel going to foreign ports carries on board in order to prove its nationality. A vessel of 20 register tons burden or more, which has been registered, can be *mortgaged for claims*, which gives the creditor mortgagee-rights in the vessel. Mortgages

on vessels are applied for before the City Court of Stockholm. A vessel's *home-port* is decided on by the owner, who must give notice of it for registration.

Amongst the provisions regulating the *rights and duties of the master*, those laying upon him the chief care and responsibility for the sea-worthiness of the vessel are particularly important. The master's duty with regard to the seaworthiness of the vessel covers not only the vessel itself, but also the equipment, crew, provisioning etc., the stowing of the cargo, and everything appertaining thereto. During the voyage he shall do everything to keep the vessel in a seaworthy condition. Neglect of this entails punishment, which may also under certain circumstances fall upon the owner or other person who, in the owner's place, has had anything to do with the vessel. Under special circumstances, defined in the maritime law, the master has to take measures for making an inspection of the vessel, to make a written report to the Board of Trade, i. e. the nearest consul and render his maritime declaration, etc.

Up to the present time, the control of the seaworthiness of ships in general has only been exercised in this manner, that is has been chiefly a restraining control. Only the passenger and emigrant ships have, as a rule, been subjected to a preventive control as to their seaworthiness. From 1915 and onwards, however, new legislation in these questions, based on the report published in 1910 by the so-called Committee on the Safety of Navigation, will be in force, through which a directive state control will be established, with the object of superintending the observance of certain rules laid down in advance by law or ordinance as to the condition or safety of ships. At the same time, the restraining control will be in some respects developed and perfected. The preventive control is to be exercised partly by a Central Inspection Office attached to the Board of Trade and partly by local inspectors. Detailed rules as to the requirements with regard to their construction and equipment etc., which ships in general or ships employed for certain purposes are to satisfy, have also been laid down. The new legislation will give the inspection authorities the right, within certain limits, to prohibit the use of a ship with regard to which such defects or grievances are established that its use would manifestly endanger the lives of the persons on board.

A right possessed by the crew, which aims at securing the employment of *seaworthy* vessels, is that they are entitled to *obtain* their discharge if the master neglects to put the vessel in a seaworthy condition, in the event of its not being in such a condition for the voyage it is about to make; the master is also obliged to have the vessel surveyed to ascertain its *seaworthiness*, when more than half the crew demand it, and, in case of the vessel's being already laden, if the mate or engineer join in the demand for such survey.

In this connection it ought to be mentioned that, when a *maritime declaration* is before the borough court, *two experts* have to assist the court, and that, in the event of special technical knowledge being needed, a third expert may be called in. If a vessel has been lost or abandoned, or considerable damage has been caused by its running aground or colliding with another vessel, or in certain other contingencies, the Court shall, with the help of the maritime declaration, open an inquiry (*maritime examination*) in order *to clear* up thoroughly the causes of the disaster.

The *obligations of ship-owners towards the master and crew*, when they leave their service by reason of particular circumstances mentioned in the maritime law, are regulated by law. The cost of sending home master and crew, in cases where they have left their service at a foreign port, on account of shipwreck, condemnation, or capture of the vessel as a good prize during war, is defrayed by the State.

The maritime law regulates the *relation between consigner, charterer and con-*

signee, such as the signing of a charter-party or agreement concerning the carriage of goods; the calculation of lay days or time of waiting allowed by the charter-party for loading or unloading; the legal relation between the charterer and consignee according to the bill of lading; the raising of a bottomry-loan, or loan with the vessel, freight, or cargo as pledge. It contains also provisions concerning wrecks, damage by collision, salvage money, marine insurance, etc. It ought to be mentioned that the so-called silent prior rights, the maritime claims proper which carry with them the right of pledge of vessel and cargo, entitle those possessing them to the settlement of claims before those due to other creditors. Amongst these maritime claims are the claims for pay due to master and crew, and the prescription period for this claim is one year from the date on which the service ceased. The prescription periods for other claims is fixed by the provisions of common or of maritime law.

The crew of a Swedish vessel *shall be signed on* as the law directs when the vessel runs to foreign ports, or, if it only plies between home ports, when the ship is to be assigned to the 1st or 2nd class of passenger vessels; this rule, however, does not apply if the voyage undertaken is only a pleasure voyage or some other occasional voyage. Also in other cases the master is entitled to have the crew signed on. In Sweden itself shipping as well as paying-off the crew is effected by the representative of the Seamen Registry Office, or in some cases by the town clerk; abroad by a Swedish consul. When shipping a crew on a Swedish vessel within the kingdom, it has to be observed that two thirds of the crew, including the master, are Swedish subjects; that every member of the crew is entered on the list at a Swedish *Seamen Registry Office* and is in possession of a *sailor's book*, unless he is, or has been, in the navy; and that the vessel carries the proper officers. When men are shipped abroad, less stringent regulations are in force. The person signing on the crew has also to see that every member of the crew is supplied with a *contra-book* by the master, as well as that the master, in cases where such are prescribed, has a ship's log and an engine-room log of the prescribed description; besides this, he is to make the necessary entries in his *register of seamen shipped* and to prepare a *muster-roll* of the vessel, unless such has already been done. Even for foreign vessels, there are, in Sweden, certain obligations to be observed when shipping a Swedish seaman, in which connection it is necessary to draw up a fixed agreement between the master and the Swedish seaman. The number of the crew of a Swedish vessel shall be kept up to that appearing in the muster-roll.

On a merchant ship of 30 tons or more (gross) burden, as well as on every passenger vessel — with which in this connection is meant a merchant vessel used for the conveyance of passengers, which, apart from the crew and other persons engaged or performing duties on the vessel, has accommodation for more than 12 persons paying for accommodation — there is to be a *qualified master* as well as other *qualified officers*. As regards what is to be looked upon as a qualified officer in every particular case, detailed rules are laid down for the different routes (in home waters, the Baltic, European waters, Atlantic trans-oceanic routes etc.) taken by the vessel, its nature (steam-ship or sailing vessel) its burden, horse power, etc. Competency is based upon certificates issued by the Board of Trade, of which there are, for deck officers, four kinds: captain's certificate, mate's certificate, skipper's certificates of the 1st and 2nd class. For the engineers the Board issues certificates of three classes. As qualification to act as master a captain's certificate is required: for voyages in the Baltic on all passenger vessels, for European voyages on steam ships and on sailing vessels of over 500 tons burden, and for trans-oceanic voyages on all vessels. For motor vessels regulations corresponding to those for steam-ships are in force with regard to the deck-officers.

For obtaining the above-mentioned certificates it is necessary to have satisfied certain theoretical and practical requirements; with regard to the deck-officers, these must, furthermore, be Swedish subjects. For obtaining a mate's certifcate it is necessary to have completed 19 years of age, for a captain's certificate, 21 years. One condition for obtaining a captain's certificate is the possesion of a mate's certificate.

For the security of navigation there are also some enactments in the ordinance concerning measures for *avoiding collisions, etc.* containing both international regulations accepted by Sweden and special regulations concerning navigation in Swedish waters. With regard to signal-lights on board ship detailed rules have been laid down. For the purpose of security to navigation, regulations are also in force concerning the conveyance of explosives and inflammable oils on board ship.

The State has, moreover, fixed the limits of activity in the matter of navigation and commerce exercised by *shipping agents* and *ship-brokers*, just as the State has ratified an ordinance for *average adjusters*. In this connection attention might also be drawn to the duties with regard to assisting persons carrying on shipping and commerce which has been imposed on the *Swedish Consuls*. According to the consular ordinance of Sep. 24, 1906, supplemented by the consular instructions of April 27, 1908, consuls are bound to the best of their ability to try and advance the Swedish interests, especially with regard to commerce, navigation, industry, etc. and to give to captains and crews of Swedish vessels, as well as to other Swedish seafaring folk, such information and such assistance as they are able to do in virtue of their office.

Through *treaties* with most of the seafaring nations, Sweden has secured to her shipping, on condition of reciprocity, the most-favoured-nation treatment, or a national treatment, in foreign ports. Freight-carrying in Sweden (Coastwise trading, cabotage) has, however, only been conceded to Belgian, British, Danish, Italian, Dutch and German vessels.

Shipping Dues.

In accordance with Swedish legislation there are general dues on shipping to be paid, partly in Swedish ports by Swedish and foreign vessels, partly abroad by Swedish vessels. These dues are, as a rule, calculated on the net register tonnage of the vessel. This latter is ascertained by **measurement.**

Prior to 1874, the measurement in Sweden was based upon the weight of cargo the vessel was able to carry, and a corresponding tonnage was calculated for the vessel. In the said year the Moorsom system, already adopted by many seafaring nations a number of years previously, was introduced into Sweden, by which the capacity of the vessel was made the basis of the survey and determined its *burden*, expressed in register tons (1 reg.-ton = 2·83 cubic meters = 100 English cubic feet). The tonnage on which dues have to be paid is obtained by deducting from the total capacity the space intended for the master and the crew, as well as that for the machinery used for propelling, navigating, and manoeuvring the vessel. Concerning the deduction from a steamer's capacity for engine room and coal-boxes, a distinction is made between the so-called *British rule*, according to which a percentage depending upon the relation between the capacity of the engine-room and the gross tonnage, is deducted from the latter; and the so-called *German rule*, according to which the actually measured capacity of the engine-room and the coal-boxes is deducted. Most of the seafaring nations apply the British rule when measuring steamers. In Sweden this rule was also introduced by the ordinance of 1874, but in 1880 already a

change was made to the German, which is still in force, but with the right for steamers to have their burden also calculated after the British rule, and the result thereof entered in an appendix to the Bill of Tonnage. Quite lately, a return to the British rule has been urged from several quarters, and experts consulted in 1911 have submitted a proposal for the revision of the regulations concerning the measurement of ships, which would be necessitated by the suggested change to the last-mentioned rule.

General **dues in Swedish ports** for Swedish and foreign vessels are: lastage, pilotage, light-house, and light-ship dues, tonnage fees to the Seamen Registry Office, harbour-dues, and land money.

The *lastage*, which in the decade 1877—85 was 14 öre per ton, was, in 1885, reduced by 4 öre and is the same for Swedish and foreign vessels, being 10 öre (1·3 d) per ton, according to the bill of tonnage. They are payable each time a vessel enters from or clears for a foreign port, as the case may be. If a vessel makes several voyages during one calendar year between Sweden and a foreign port, these dues are paid only when leaving for the first voyage, and on return only when the vessel carries a cargo and unloads a greater or smaller portion thereof, in which connection a vessel is considered as being in ballast when the cargo falls below one tenth of the vessel's net register tonnage. A vessel which, on its voyage between foreign ports, loads or unloads in a Swedish port goods amounting to not more than one fourth of its burden is exempt from the payment of dues.

Pilotage fees. Swedish legislation combines, as a rule, compulsory pilotage with pilotage fees. A vessel making voyages betwen Swedish and foreign ports, which has to pass through some pilotage channel, where the vessel has paid pilotage fees 10 times during the current calendar year, in the case of a steamer or steam barge, and 6 times in the case of a sailing vessel, is exempt from pilotage fees for the remainder of the year, provided the foreign port lies within the line Lindesnäs—Hanstholm; but these fees are reduced by one half, if the foreign port lies beyond the said line. Vessels of 40 tons and under are exempt from these dues, likewise steamers making regular voyages between Swedish and Danish ports on the Sound, as well as certain other vessels.

The *light-house dues*, which, formerly, were also levied on vessels trading between home ports, are now levied only on foreign-going vessels of more than 40 tons. Every vessel arriving from or leaving for a foreign port has to pay dues of 25 öre per register ton, but in the event of such dues having been paid, in the case of a steamer or steam barge eight times, and in the case of a sailing vessel four times, the vessel is exempt from further payment of these dues during the remainder of that year.

Exemption from the afore-mentioned three kinds of dues is granted to vessels calling for orders, coaling, or provisioning, as well as to vessels forced to seek a refuge, Crown vessels, and others.

The tonnage-fee to the Seamen Registry Office for a vessel leaving a Swedish port for a foreign one is 3 öre, if the vessel be Swedish or belongs to some foreign nation in whose harbours Swedish vessels enjoy national treatment, but otherwise 5 öre — everything per ton according to Swedish or equivalent foreign bill of tonnage. If a vessel leaves a Swedish port several times in the course of a calendar month, the fee is payable only once a month.

Harbour-dues are levied upon vessels and goods in conformity with special tariffs ratified by the Government, with the application of certain main principles, on the advice of the authorities, and in force for five years.

Land-money is levied for vessels utilizing institutions for shipping at certain sufferance-wharves, chiefly in Norrland, after the owners have obtained Government permission to levy the duties according to a tariff fixed for that particular case.

The *measurement dues* in Sweden at present fall, as a rule, upon the owner. For bills of tonnage and some other shipping documents, stamp- and office-fees are payable.

Abroad, Swedish vessels nowadays do not pay any other fees except, in Great Britain, a fee to the Swedish Church in London, as well as such fees or dues as have the character of *office-fees* to the consul. The fee to the Swedish Church in London amounts to 0·6 penny per ton for vessels arriving in London, and to 0·3 penny for vessels arriving at other ports in Great Britain and Ireland.

Sailors.

On account of the peculiar nature of the sailor's calling, the conditions under which that profession is to be pursued have from ancient times been made the subject of special legislation. The present regulations on the subject are contained in the *Maritime Law of 1891* with the statutes incorporated therewith. That Act prescribes in detail the duties and rights of the crew and the master reciprocally and in relation of the ship-owner, as well as the extent of the master's responsibility for the vessel. In order to maintain the rigorous discipline which is so necessary on board ship, and to prevent the crew being able to leave the ship then and there on the slightest occasion arising, the law has deposited very extensive disciplinary powers in the hands of the Master, and made the conditions of the seaman's articles more rigorous, which has correspondingly diminished the personal liberty and independence of the crew. (See the section: Maritime Legislation).

As to the amount of the *wages* (hire) to be paid in different cases to the master and crew, the law says nothing. This is a matter entirely dependent on a free contract between the shipowner, the master and the crew. The salary of the Master, which, obviously, varies greatly according to the size of the ship and the voyage on which she is bound, consists, as a rule partly of a fixed salary, partly of a commission on the freight earned. This commission in Sweden is called *kapplake*. The masters of large steamships have as a rule from 5 000 to 6 000 kronor, those of smaller steamers from 2 000 to 4 000 kronor as a total yearly income. According to data obtained from the Seamen Registry Office, the average monthly wages in 1912 for different ratings of officers and crew in the Swedish merchant fleet was as follows:[1]

Rating	Steamer kr.	Sailing-ship kr.	Rating	Steamer kr.	Sailing-ship kr.
First Mate	130	90	Carpenter	70	65
Second Mate	100	75	Able-bodied Seaman	55	50
First Engineer	200	—	Ordinary Seaman	45	25
Second Engineer	125	—	Steward	90	65
Quartermaster	80	—	Cook	55	30
Boatswain	75	70	Stoker	60	—

The hours of work on Swedish ships sailing to foreign countries are 12 hours a day (from 6 a. m. to 6 p. m.) with two hours' interval; On coasting vessels the working hours vary greatly owing to the shorter voyages and the numerous stoppages; but they do not appear to exceed 12 hours on an average. When the work is divided into "shifts watches", the number of hours into which a watch is divided varies.

Lodgings. Under the Royal Decree of 1894, a deduction may be made for lodgings from the gross burden of the ship, provided that each room or

[1] In the following two years the wages have been considerably raised.

cabin is exclusively appropriated to the Master or the crew, but subject to the stipulation that the room or cabin shall have a capacity of at least 2·04 cub. m and a minimum floor area of at least 1·11 sq. m per person accommodated, and moreover come up to a certain minimum standard with respect to hygiene and seaworthiness. The spaciousness of the lodgings on board Swedish merchant ships, as a rule, far exceeds these minimum requirements, but the sanitary arrangements and comfort are badly in need of improvement. The same may be said of the *scale of food* prescribed by the Royal Decree of 1896 for the crews of Swedish vessels. The legislative proposals drafted by the *Committee on Safety of Navigation*, which, at the present moment of writing, have been passed by the Riksdag, also contain considerable ameliorations for the better accommodation and the food on board. With a view to obtaining a foundation on which to rear further reforms of the labour conditions of seafaring men, a statistical investigation with respect to the sailor's standard of life is at present being made by the *Royal Social Board*.

The peculiar, the severe conditions under which the sailor exercises his profession, have been deemed in Sweden, as in other countries, to call for special sollicitude on the part of the body public. The State institutions for this purpose are the Sjömanshus, *Seamen Registry and Shipping Offices*, and Handelsflottans pensionsanstalt, the *Mercantile Marine Pension Fund*.

Sjömanshus, shortly *Seamen Registry Offices*, are found in 47 of the shipping towns of Sweden. It is part of their mission to afford relief to sailors of all ratings in distress or out of work, and to their widows and children. The costs of these institutions are defrayed partly by the *tonnage fees* paid by the shipowners and the sailor's own *shipping fees* (*hyresavgifter*), paid by all Swedish sailors on board ships sailing to foreign countries, inclusive of the masters, at the rate of 1 % of their wages or salary, and thirdly by State subvention. In 1912 the tonnage dues amounted to 192 916 kronor, the shipping fees to 125 848 kronor, and the State grant to 40 000 kronor. In the same year the sum expended in annual and occasional aid was 288 660 kronor, wages, salaries and expenditure ran into 215 399 kronor; and the balance at the end of the year figured at 134 247 kronor. The aggregate balance of capital held by the *Sjömanshusen* was 6 029 563 kronor, which sum also includes donations. Each *Sjömanshus* is governed by a Board, consisting of elected members representing the shipowners and sailors of various ratings. The *Sjömanshus* are subject to the supervision of the Board of Trade, which, at the recommendation of the Board, appoints their Commissioner, who is a salaried official, with fiscal duties.

The *Mercantile Marine Pension Fund* was founded in 1864 as a set-off to the right enjoyed by sailors on board ships sailing to foreign countries to introduce into Sweden free of duty a certain quantity of goods (known as *föring*). The State grant to this Fund was in 1912 174 075·36 kronor. Pensions are granted to Swedish sailors who have been principally employed on board ships sailing to foreign countries after attaining the age of 55, provided they have been entered for 25 years on the Seamen Registry Offices. The pensions are divided into four classes, of which the two first are intended for certified masters, the third for other masters as well as mates and engineer, and the fourth for other sailors and stokers on steamships. The number of pensioners in 1912 was in

			Kr.
1st class	324	at the rate of 160 kr.	51 840
2nd »	328	» » » 120 »	28 560
3rd »	233	» » » 100 »	23 300
4th »	1 140	» » » 60 »	68 400
		Total	172 100

However, there has long been a feeling among sailors that their pension and relief system is quite inadequate for their needs, and not sufficiently centralized. An attempt to meet these demands was made by the *Sailors' Pension Committee* (1900—04). What that Committee proposed was a combined Accident and Old Age Insurance, towards which fees were to be paid by all Swedish sailors. That proposal, however, did not lead to any definite results. The matter was referred to the consideration of the Old Age Insurance Committee, whose scheme for combined *national* pension and insurance system, which the Riksdag of 1913 passed into law, naturally embraces all the seafaring classes. That Committee has moreover been instructed to draft proposals for a law providing for the accidence insurance of sailors. In spite of their perilous craft with its great frequency of accidents, sailors fall outside the purview of the Workmens' Compensation Act of 1901. Nevertheless shipowners have not deemed themselves exonerated from insuring the crews of their ships, which they have done, as a rule, at their own expense.

A Society has been founded to take measures for diminishing to the greatest feasible extent the numerous cases of drowning which occur in connection with the stranding and wreckage of ships. It is called "Svenska sällskapet för räddning av skeppsbrutna" (The Swedish Society for the Safety of Life at Sea), and its object is to arouse the interest of the public in this matter, and to establish *Lifeboat Stations* in places along the coast of Sweden particularly exposed to shipwrecks and still in need of such stations.

As the sailors spend a great part of their time outside the purlieus of Sweden, and as a considerable number of Swedish sailors are engaged in foreign service — at certain times during recent years no less than 6 000 Swedes, that is a sixth of the total manning strength of the Swedish merchantile fleet, have been employed on board English vessels — measures have been adopted in large foreign ports to afford them assistance and protection, such as sailors' homes, sailors' churches with chaplains, and so forth. In order to encourage them to thrift, the savings of Swedish sailors are forwarded carriage free from places abroad to Sweden, through consular channels.

The kind of corporate feeling which has always prevailed among sailors, and in virtue of which the youngest ordinary seaman on board may one day look forward to pace his own deck in the proud capacity of a certified Master, and possibly of shareholder in the ship, has discouraged the growth in the seafaring profession of sharp social distinctions between employers and employed. Whether the modern development which shipping has been undergoing, the larger scale of operations on which that trade its now tending to be conducted, the amalgamation of shipping lines into large trusts, the gradually increasing size of the units, is likely to effect a revolution in these conditions, time only can show. The partriarchal peace which has hitherto prevailed in labour conditions in the shipping profession has naturally been promoted greatly by the fact that the relations between shipowners, officers, and crew have been regulated by law. The conflict of interests in this sphere of labour has thus taken the direction of legislatory reform. The interested parties have been represented by different *unions*, the shipowners by *Sveriges Redareförening*, the officers by *Sveriges Fartygsbefälsförening*, the certified engineers by *Svenska Maskinistförbundet*, and common sailors by different local trade unions. The crews of numberless small craft, steamers, tugs, and barges employed in the shipping, the coasting and the canal trade are not sailors in the ordinary sense of the word, and therefore belong, as far as they are organized (which is only in a minor degree), to *Svenska Transportarbetareförbundet*.

Collective Bargaining, which, though restricted in several respects by the maritime law, is legitimate in the shipping trade, in point of fact occur very

seldom. At the present moment of writing there are only a few in force, notably that concluded between the two most prominent trade organizations on both sides, *Sveriges Redareförening* (representing the shipowners) and *Svenska Maskinistförbundet* (representing the engineers). The Shipowners' Association is extremely well organized. Although only formed in 1906, at the close of 1912 it embraced 157 shipping companies with 446 (steam)ships aggregating 594 480 gross register tons, and with crews numbering 7 850 men. The Shipowners' Association has moreover established a *Maritime Labour Exchange,* superintended by its officials and based on fees paid by the owners of ships with offices in the larger ports of Sweden. In 1911 as many as 11 663 vacancies were filled through its instrumentality.

Photo. SVANTE HÆGER, Lysekil.

Old Swedish Pilot.

X.

INTERNAL COMMUNICATIONS.

1. RAILWAYS.

The building of railways was commenced late in Sweden, but once begun, it was continued with great energy. On the whole, the network of railways in Sweden, such as it is now in the second decade of the present century, forms the greatest economic achievement that the nineteenth and twentieth centuries can boast of in that country.

The real pioneer of railways in Sweden was Count *A. E. von Rosen* (1797—1886). In 1845, this nobleman received a concession to build railways in the central and southern parts of the country, on a magnificent, if also somewhat ambitious, plan, which, otherwise, in its characteristic features, is closely identical with that of the present Government railways. Although von Rosen, on

TABLE 125. *Length of Railways in Sweden.*

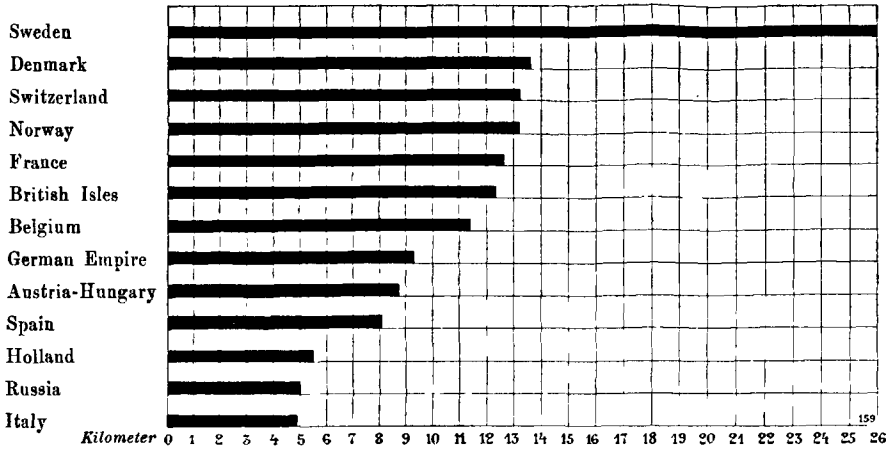
At the end of the years	State railways[1]	Private railways	Total	Of which in		Gauge	
				Southern Sweden	Northern Sweden[2]	Normal	Narrow
1860	303	204	**507**	375	132	496	11
1865	869	416	**1 285**	1 138	147	1 177	108
1870	1 118	590	**1 708**	1 561	147	1 457	251
1875	1 513	2 168	**3 681**	3 344	337	2 996	685
1880	1 956	3 923	**5 879**	5 075	804	4 638	1 211
1885	2 385	4 505	**6 890**	5 602	1 288	5 508	1 382
1890	2 613	5 405	**8 018**	6 438	1 580	6 343	1 675
1895	3 269	6 486	**9 755**	7 234	2 521	7 744	2 041
1900	3 849	7 453	**11 302**	8 354	2 948	8 681	2 621
1905	4 199	8 449	**12 648**	9 290	3 358	9 756	2 892
1910	4 418	9 411	**13 829**	10 228	3 601	10 551	3 278
1911	4 453	9 489	**13 942**	10 306	3 636	10 636	3 306
1912	4 610	9 561	**14 171**	10 367	3 804	10 854	3 317
1913	4 688	9 689	**14 377**	10 552	3 825	11 010	3 367

[1] Exclusive of the steam railway-ferry route. — [2] The five northernmost läns and Kopparberg Län.

The most important
Traffic Routes
to
SWEDEN.
Narvik
Torneå
Luleå
NORGE
FINLAND
Trondhjem
Vasa
SVERGE
Sundsvall
Åbo
St Petersburg
Bergen
Kristiania
Hälsingfors
Stockholm
Göteborg
Riga
Edinburgh
Newcastle
DANMARK
København
Malmö
Trelleborg
STORBRITANNIEN
Hull
Sassnitz
Lübeck
Hamburg
Stettin
London
Amsterdam
Haag
Berlin
Warschau
Dover
Calais
BELGIEN
Bryssel
Köln
Dresden
Le Havre
Frankfurt a/M
Paris
Strassburg
München
Wien
Budapest
FRANKRIKE
Bern
SCHWEIZ
UNGERN
Bordeaux
Triest
Genua
Belgrad
Bukarest
Marseille
Sofia
ITALIEN
Barcelona
Rom
Neapel
Brindisi
Salonik
165

123483.

Railways at the end of 1912, in proportion to Population.
(Kilometers per 10 000 Inhab.)



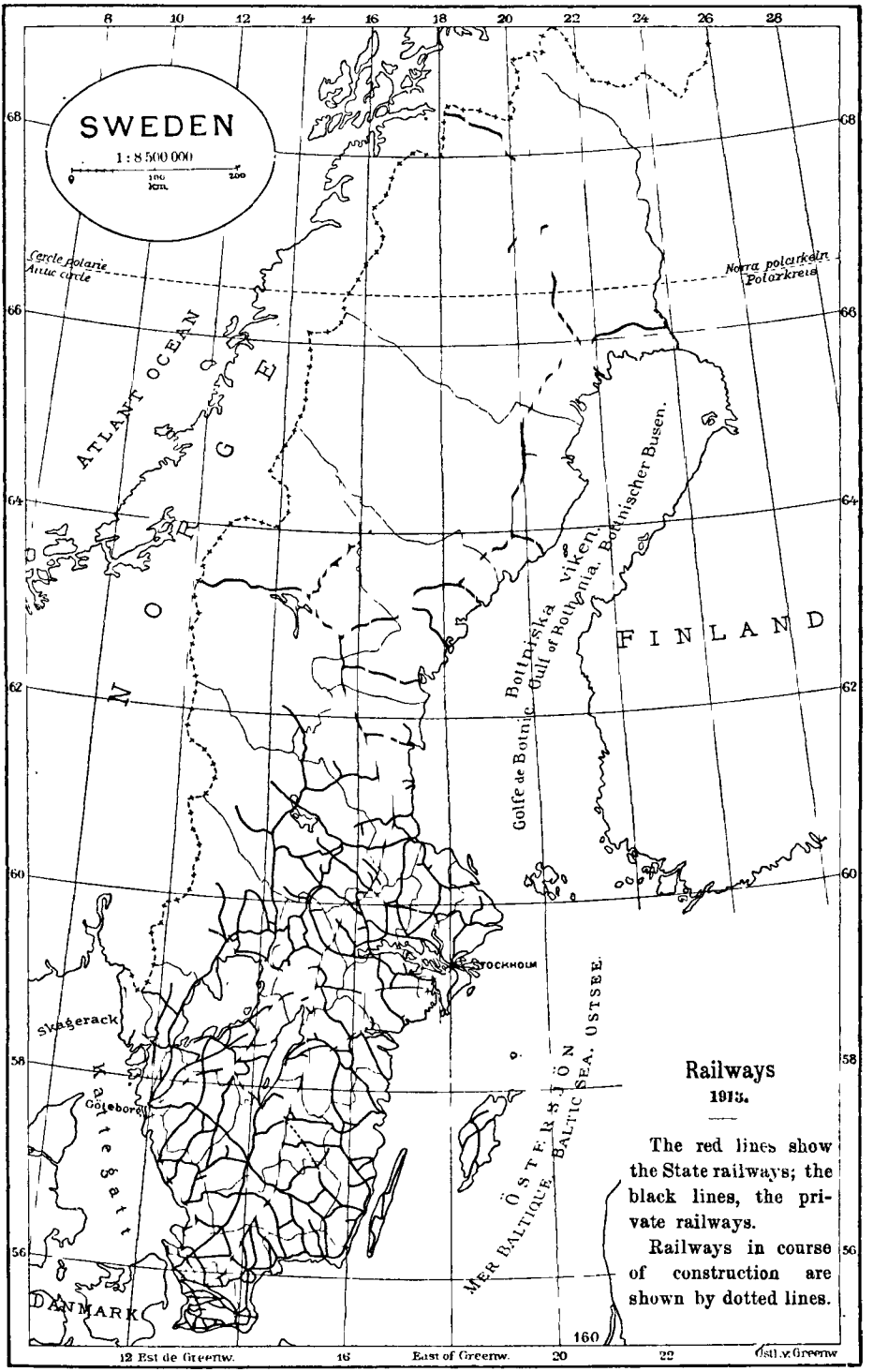
account of the general hesitation to embark in the hazardous enterprise, was not actually able to carry out more than an insignificant part of his scheme, he nevertheless succeeded by his unwearied energy in winning recognition for his views as to the necessity of railways. Contrary to Rosen's plan of providing the country with a system of private railways, the Riksdag of 1853 resolved, however, that the main lines should be constructed as Government ones.

The commission to carry into effect this resolution was entrusted in 1855 to *Nils Ericson* (1802—70), already known as a canal constructor, who for this purpose was invested with extraordinary authority[1]. Nils Ericson constructed several of our Government lines and drew up plans for all the Government railways in Central and Southern Sweden. The first Government line was opened on December 1, 1856; the first private one, some months previously. For the further development of the Railways, see Table 125, and the accompanying diagram.

At the end of 1913, Sweden possessed about 14 377 kilometers of railways in actual use, besides which about 2 200 km are in course of construction or have concessions granted. In proportion to *population*, Sweden has more railways than any other country in Europe. For every ten thousand inhabitants, Sweden possesses 26 km, of railway, while Denmark, which comes next, has only 13·6. The average figure for the whole of Europe is 8.

Having regard to the sparse population of Sweden, it is natural enough that circumstances are somewhat different, when the network of lines is compared with the *area*. For every ten thousand hectares, Sweden has 3·2 km of railway, a by no means insignificant figure, seeing that the average

[1] Nils Ericson was a brother of the celebrated *John Ericsson* of whom, by the way, it may be mentioned, that he, too, has left a name in railway history. In the memorable competition at Rainhill, in October, 1829, John Ericsson, also took part, and would in all probability have proved victorious over Stephenson, had not his locomotive met with a temporary accident.



123483 Gen. Stab. Lit Anst Stockholm

New Railways opened for Traffic in Sweden each year during the period 1856—1913.

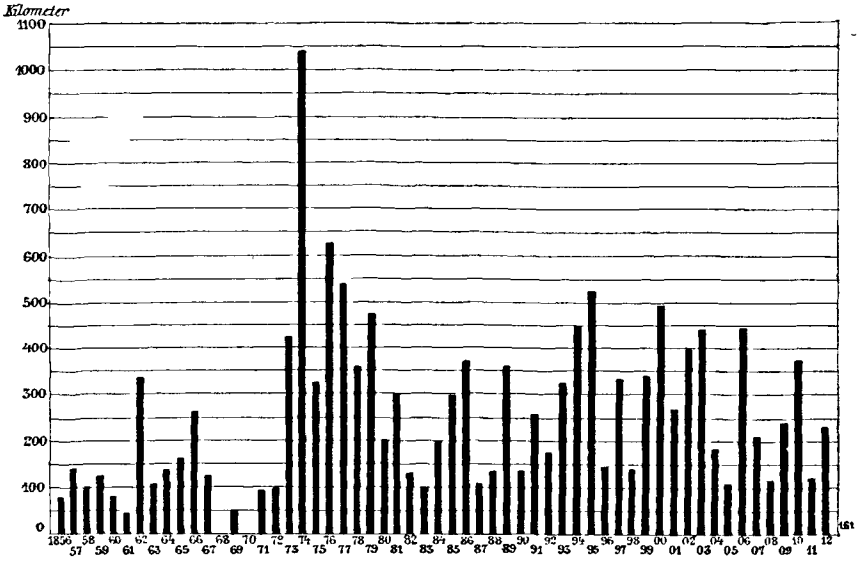


figure for Europe is 3·4; but the inferiority of the figure for Sweden is here chiefly due to the enormous distances in North Sweden. If the six läns situated farthest to the north are left out of consideration, the figures rises to 7 km per ten thousand hectares, which is about the same as in Italy. And Malmöhus Län even reaches 19 km for the same area, which is more than the average for any other countries in Europe, with the exception of Belgium and Luxemburg. Kristianstad Län has about 12 km of railways per ten thousand hectares, or the same as that possessed by the British Isles, while Blekinge Län has about 11 km, which is approximately the average figure for the German Empire. The mining districts of Central Sweden are also particularly well provided with railways.

Of the whole length of railways lines in use in Sweden at the end of 1913, 4 688 km were *State lines* and 9 689 km were *Private lines* (cf. Table 125). The most important lines in Sweden at present are the following:

State railways. *a*) Stockholm—Malmö—Trälleborg 649 km, the principal route of communication with the Continent; direct steam-ferry communication by sea is effected via Sassnitz with Germany; at Malmö there is also direct steam-ferry communication with Copenhagen (see below); *b*) Stockholm—Gothenburg, 458 km, to Katrineholm station in common with the above; *c*) Stockholm—Christiania, 575 km, to Laxå in common with the above; 439 km of the whole length belong to Sweden, and 136 km to Norway; *d*) Stockholm—Uppsala—Bräcke—Boden—Kiruna—Riksgränsen (frontier-station) 1 542 km, with a continuation on the Norwegian side to Ofoten on the Atlantic; from Boden there is a branch line running towards the Finland frontier; *e*) Sundsvall—Ånge—Trondhjem, 465 km, 363 km of which belong to Sweden and 102 to Norway; by means of this line, the Gulf of Bothnia and the Atlantic Ocean

are joined six or seven hundred km farther to the south than by the line last mentioned; *f*) Mjölby—Örebro—Krylbo, 253 km, which considerably shortens the distance between the State railways in the north and in the south of Sweden; *g*) Trälleborg—Malmö—Gothenburg—Christiania, 738 km, 381 km of which is the property of the Swedish State, 188 km belong to private Swedish companies, and 169 to the Norwegian State; *h*) the railway running lengthwise through Bohuslän, between Gothenburg and Strömstad, 181 km.

The **private railways** are distributed between about 150 company-proprietors and therefore only occasionally form large complexes. Of the most important lines may be mentioned: Stockholm—Örebro—Svartå, 267 km, lately, partly (Frövi—Svartå, 75 km) taken over by the State; Uppsala—Gävle—Ockelbo, 175 km; Gävle—Falun—Orsa, 194 km, leading to the picturesque country round lake Siljan; Kristinehamn—Mora—Älvdalen, 262 km, between the lakes Vänern and Siljan; Gothenburg—Falun, 486 km, west of lake Vänern; Halmstad—Nässjö, 280 km and Nässjö—Oskarshamn, 148 km; Karlskrona—Växjö—Alvesta, 132 km, in connection with Alvesta—Värnamo—Gothenburg, 245 km; Hälsingborg—Jönköping, 246 km, from Öresund to lake Vättern; Örebro—Pålsboda—Norsholm—Hultsfred, 300 km, etc.

During the last few years, attempts have been made in different places to unite, under one management, private lines situated near each other, and special mention should be made in this respect of the Traffic Joint-Stock Company Grängesberg—Oxelösund (established in 1896), which to a large extent has acquired Frövi—Ludvika, Frövi—Köping, and Oxelösund—Flen—Västmanland railways (altogether 300 km) and does a considerable business in the carriage of iron-ore from the Grängesberg mines (also acquired by the Company) in Dalarne, to the harbour of Oxelösund on the Baltic, for export abroad.

Since a few years back, the Gävle—Dala, Stockholm—Västerås—Bergslagen, and Bergslagernas railways which all carry on a lively traffic between the south-western parts of Sweden, Dalarne and the coast towns of central Norrland, have been under a common administration called The Traffic Administration Gothenburg—Stockholm—Gävle.

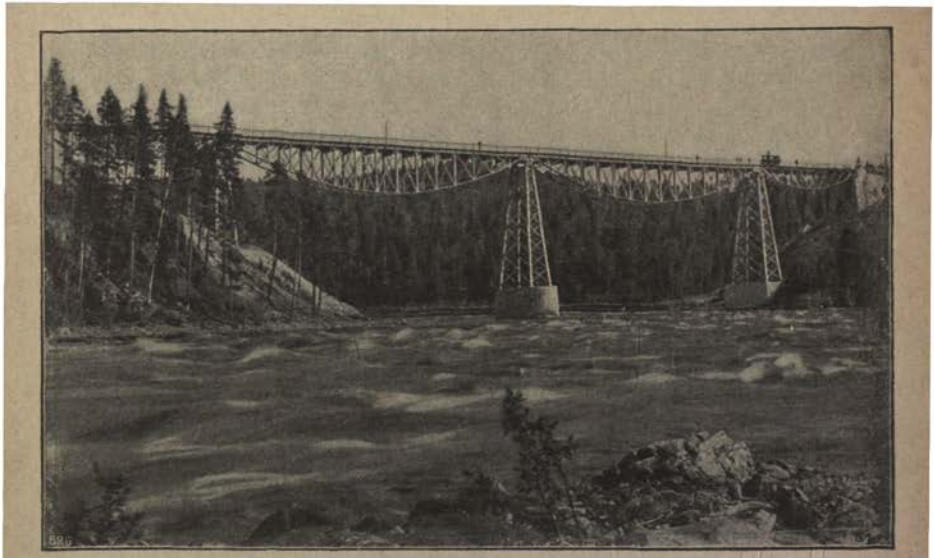
To the construction of a large number of our private railways the State has contributed with considerable subventions, in all about 92 million kronor, chiefly in the shape of loans on favourable conditions, besides which, the terms of construction, with respect to private railways, have, in general, been made as little burdensome as possible from the side of the State. The position the State has thus assumed as advancer of capital to no mean extent for private enterprise in the domain of railway building, has powerfully contributed to the development — which is exceedingly great for Swedish conditions — which the private railways have attained. — Something like 900 km of railway built by private companies have been purchased by the State at various times.

As regards the **form of construction** employed, it may be mentioned that all the Swedish railways are *single-tracked*, with the exception of the sections on the State railways, Stockholm Central—Uppsala, and Stockholm Central—Rönninge, with a total distance of 94·3 km; Malmö—Hässleholm, 83·3 km, and Gothenburg—Jonsered 13·3 km. Double tracks will probably be laid down in course of time on the chief lines in Southern and Central Sweden.

On six of the private lines, double tracks are already laid, to a length of 26 km.

All the State railways are *normal gauge* (1·435 meters) and so are 65 %

of the total length of the private lines. Altogether, Sweden has 11 010 km of normal gauge lines and 3 367 km of narrow gauge (cf. Table 125, page 594). Of the narrow-gauge lines, 77 % have a width of 0·891 meters, and 15 % a width of 1·067; the remaining 8 % are divided between three different gauges down to 0·6 meters, which last exceedingly small gauge (the "Kosta system") is met with on some of the smaller local lines, and has a total length of altogether 154 km.



The Bridge across the River Öre älv.

The *weight of rails* per meter on the State railways varies between 40·5 and 27 kg. Besides those lines in the extreme north of Sweden which are designed for the carriage of ore, the chief lines south of Uppsala are already partly provided with rails of the first above-mentioned weight. The weight of rails on the normal gauge private lines varies between 45 and 17·2 kg, and on the narrow gauge, between 32·7 and 9·5 kg pr meter.

On the State lines, steel rails are for the most part used, on the private lines, both steel and iron rails. The rails are generally of English, German, or Belgian manufacture. On the larger broad-gauge lines, the highest gradient is, as a rule, 1 %, and the smallest radius of curvature 300 meters. The majority of the stations on the chief lines of the State railways and a considerable number of stations on the larger private lines, have been provided with modern shunt-locking and safety signalling apparatus, this at some of the stations being in connection with a central adjusting office.

The ample supply of wood in Sweden has made the cost-price of *sleepers* so cheap that their impregnation has not been considered economical. Now, however, the State railways have begun to impregnate the sleepers, for which purpose specially designed and portable apparatus is employed.

As a particular feature of the Swedish railways, notice should be called to the numerous and, in some cases, splendid **railway bridges,** more especially in Norrland, which have been necessitated by the great number of rivers to be crossed. Many of these can be regarded as good specimens of Swedish engine-

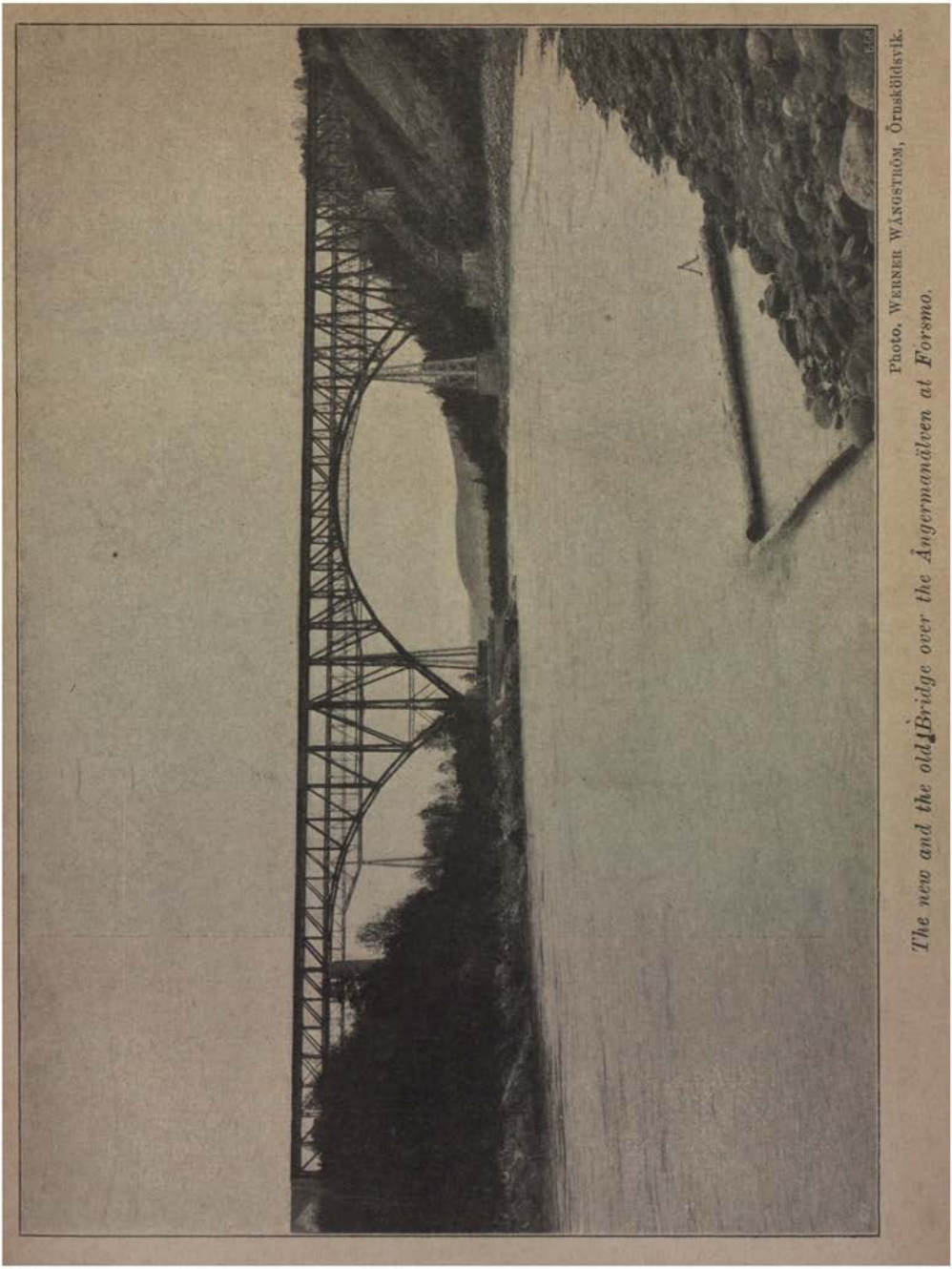


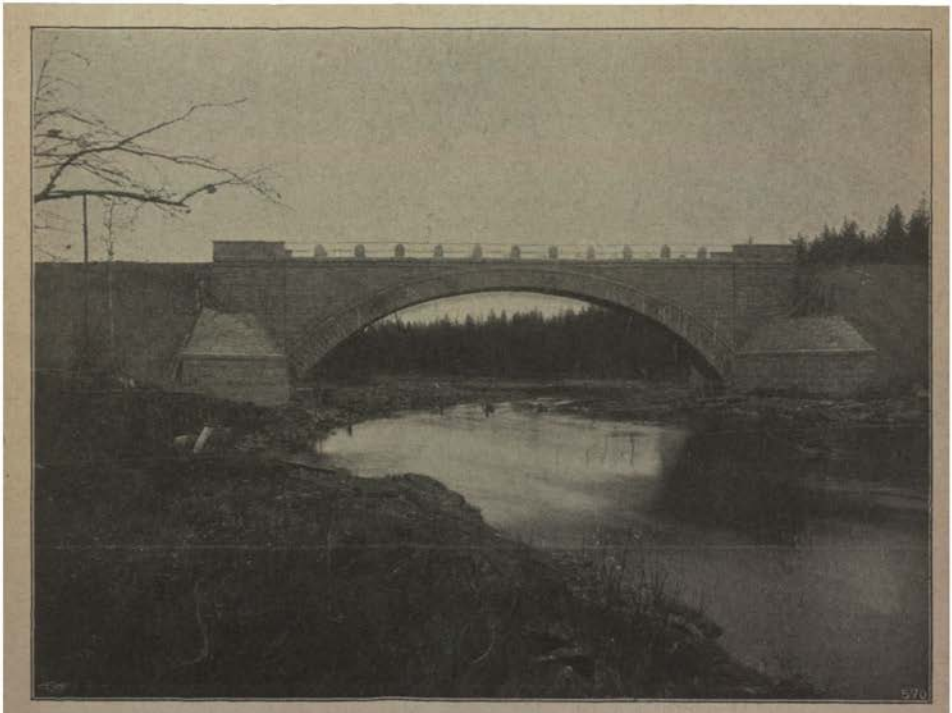
Photo. Werner Wängström, Örnsköldsvik.

The new and the old Bridge over the Ångermanälven at Forsmo.

ering skill, and among them should be chiefly mentioned the new bridge across the Ångermanälven at Forsmo, which is 263·6 meters long, and which crosses the river at a height of 48·8 meters above the lowest level of the water. It has four arches, the longest of which, spanning the steam itself, is 104 meters wide. Its construction forms the most important bridge-building work hitherto undertaken in Sweden and is worthy of special attention on account of the

method that was employed for the erection of the iron-construction of the great span across the stream.

In erecting the span across the river, no fixed supports from the river-bed were employed, as their employment would, in consequence of the great height, have added considerably to the cost of the bridge, but the iron-construction work of the central span proceeded unsupported, from either side of the river, and was continued until the two half-sections of the span met above the centre of the stream, at a distance of 52 meters from the sides, and were then united with each other.



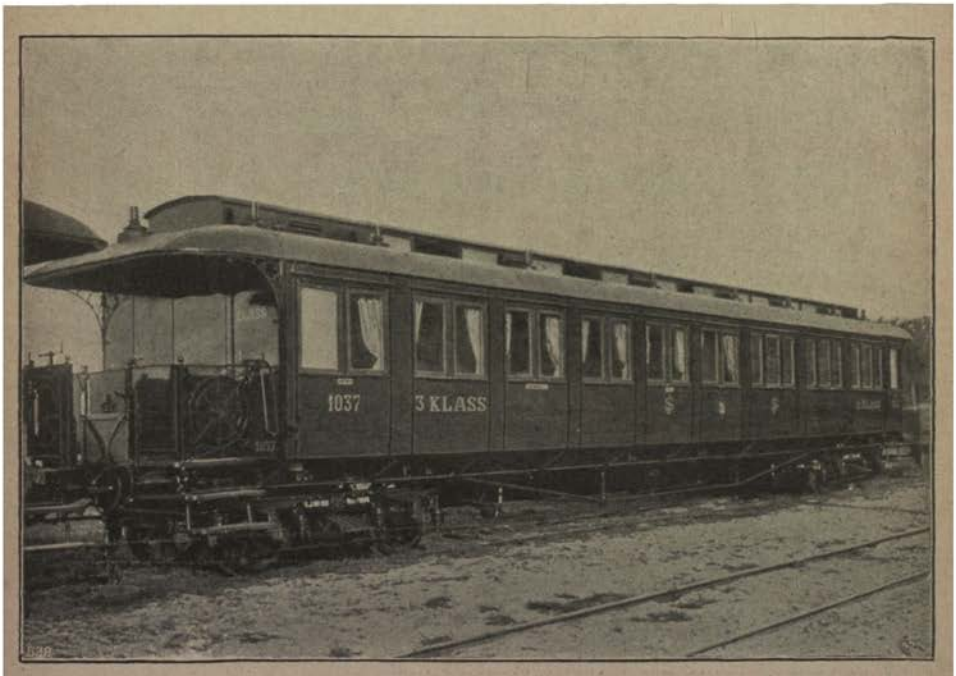
Railway-bridge (of granite) over the Flåsjöälven.

The iron track-way of the bridge weighs 1 244 tons, and the total cost of the erection, inclusive of foundations and stonework, which latter everywhere consists of granite-faced beton, amounted to about 860 000 kronor. The bridge was opened for traffic on September 26, 1912. Further may be mentioned the bridge over the Öre älv, which is 168·9 meters long and has four arches, the longest of which is 53 meters; the bridge over the Ume älv, which is 178·5 meters long and has three arches, two of which are 59·6 meters each; one of the bridges over the Vindelälven, which is 181 meters long and has four arches, two of which are 62 meters each; and the bridge over the Lule älv, which is 162 meters long and has three arches, the longest of which is 62 meters. Two important bridges have been constructed on the State line through Bohuslän, viz., those over the rivers Göta- and Nordre älvar, both erections being provided with swinging-spans, so that the bridges may not be a hindrance to navigation. The swing-bridge across the Göta älv, of a total length of 56·2 meters, is one of the largest moveable bridges in the country. The bridge over the Nordre

älv has a fixed span of 83·81 meters in width, in addition to a swinging-span, 47·18 meters wide.

While the material of the bridge track-ways of the State lines has hitherto consisted of iron, natural stone and concrete and reinforced concrete, so much in use nowadays, have been employed for arch-construction.

For example, a railway-bridge of granite and reinforced concrete, with a span of 35 meters, is at present being erected over the Flåsjöälv, in Jämtland, on the Inland Railway now in course of construction.



Bogie-car.

Among other works of skill, we must not omit to mention the *tunnel*, 433 meters long, under Södermalm, in Stockholm, and the extensive bridge-building, banking, and piling-work executed in connection with the completion of the railway through Stockholm city; also the works, noteworthy from several points of view, on the Stockholm—Saltsjöbaden line, amongst which may be specially noticed a tunnel 643 meters long in curve and gradient, and the terminus of this line at Stadsgården, in the south of Stockholm. In the same connection, mention must be made of the extensive quay-buildings and loading arrangements that have been carried out at Svartön, near Luleå, and at Oxelösund — both for the iron-ore export.

There are no specially noteworthy *station buildings* in Sweden, except the terminus at Stockholm and the station at Malmö. The important increase of traffic has, however, necessitated the rebuilding and enlargement of the stations in some of the larger towns. With this object, extensive preparatory work is at present being carried out at the principal stations in Stockholm, Gothenburg, Malmö, and Hälsingborg.

The **Rolling-stock** is of very good quality and quite on a level with that of other countries. The Swedish passenger-carriages are specially renowned for their comfort and easy running.

The total number of **locomotives** amounts to about 2 000, of which number 900 are the property of the State railways, the construction-price of this latter group of engines amounting to about 49 million kronor. During the last few years, a great number of locomotives have been made with superheating arrangement for the steam, according to Schmidt's system. Specially powerful locomotives have been acquired for the ore-traffic in Upper Norrland, the largest of them having five coupled axles and, including the tender, a service-weight of 130 tons. — The fuel used is chiefly English coal, but on the State lines Swedish coal from Skåne is also used to some extent. On one or two of the larger private lines, experiments have been for some time carried on with a device invented by Hj. von Porat, mechanical engineer, for firing locomotives with peat-powder, a fuel of which large quantities exist in Sweden.

The passenger carriages amount to a total of 3 800, of which number 1 700 belong to the State railways. The cost of construction of these latter amounts to 28 million kronor. Both on the State-, as well as on most of the private lines, *bogie-carriages* are employed, with side-corridors and a through-passage right along the entire train; these, so far as fittings and technical arrangements are concerned, are thought to satisfy the most exigent claims. Special *dining-cars* are attached to the principal day trains, and there are sleeping carriages in all the night trains. As a result of the comparatively severe climate, pains have been taken — and, on the whole, successfully — to warm the passenger-carriages in a satisfactory manner, and this has been effected by means of steam from the engine. The lighting on the State railways is effected by means of oil-gas, according to the Pintsch system, for the production of which special gasworks are established at several places. A considerable improvement in this system of illumination has been introduced during the last few years by the employment of mantles for the burners, whereby the strength of the light is very essentially increased. A large number of the private lines employ acetylene-gas for lighting their passenger-carriages. Quite lately it has been found possible to employ mantles for this system of illumination, too. Automatic vacuum-

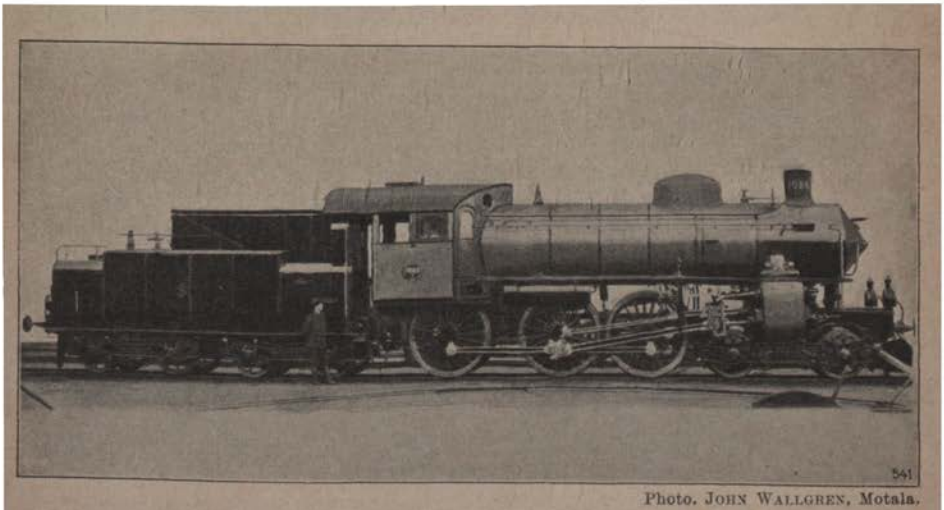
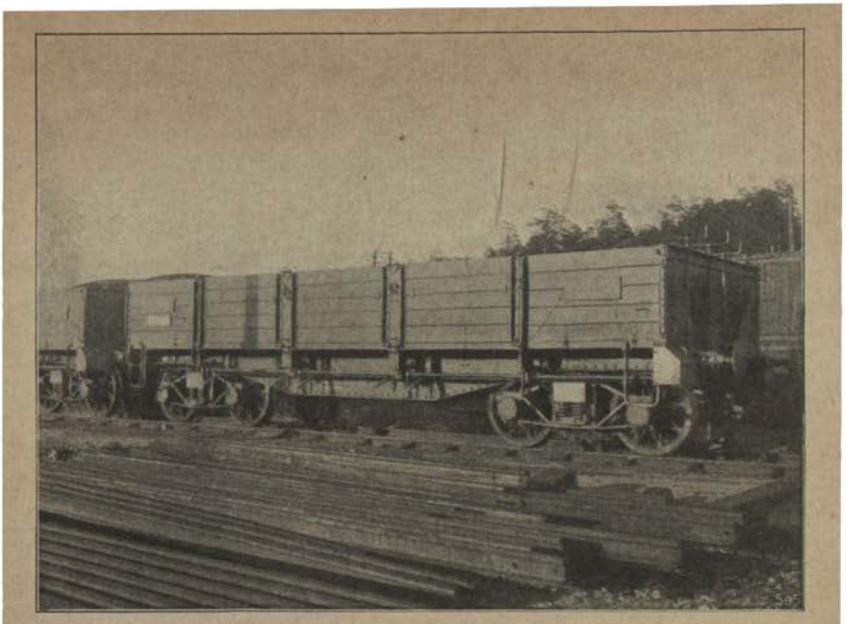


Photo. JOHN WALLGREN, Motala.

A State Railway Express Locomotive.



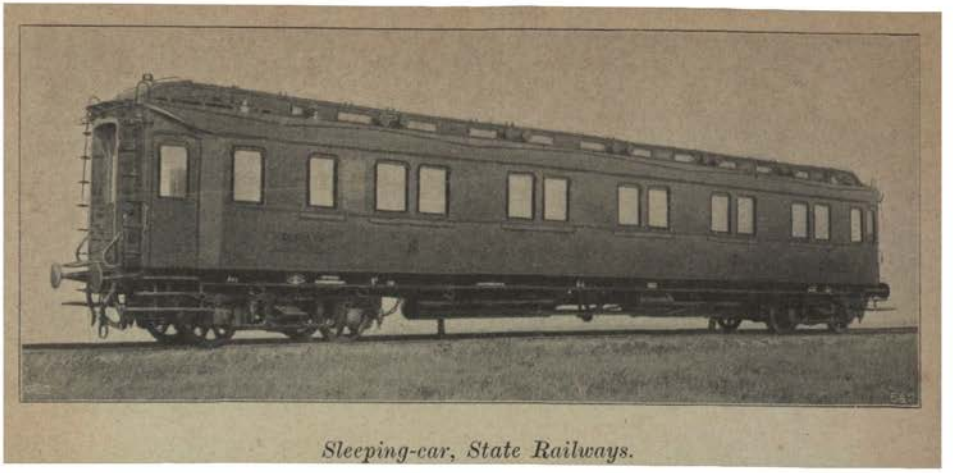
Open Freight-goods Bogie-car, State-Railways.

brakes running through the entire train, in accordance with Körting's or Hardy's systems, are in use on the express trains of all the State lines.

The **Goods waggons** of all the railways number altogether 51 000, with a total carrying capacity of about 640 000 tons. The cost of the building of the 23 000 waggons belonging to the State railways amounted to 72 million kronor. Among the different types of waggons characteristic of the country and its conditions of traffic, may be mentioned the three-axled *ore-waggons*, of which those for the conveyance of ore in Norrland have their bodies made of iron, and are now built with a carrying-capacity of 35 tons each; and also the so-called *butter-waggons*, which are constructed for the carriage of butter and other more perishable articles, and which are provided with treble walls and roofs, refrigerators, etc. There are also special waggons for the transport of cattle, of charcoal and limestone, and four-axled bogie-waggons, specially intended for the carriage of ore and with a carrying-capacity of 36 tons. The carrying-capacity of the double-axled waggons of newer types is, as a rule, 16—18 tons. The heavy ore-trains running on the line Luleå—Riksgränsen are all provided with the Westinghouse brake.

With regard to the rolling-stock of the State railways, this is, manufactured in Sweden itself. Of the *factories* which supply the railways with locomotives, the Trollhättan and the Motala Mechanical Works have brought the manufacture to a comparatively high state of perfection. The Trollhättan Works produce an average of 50 locomotives per annum, and the Motala works about 30. Factories for the manufacture, on a large scale, of rollingstock are now to be found in several places, as for instance at Falun, Malmö, Kristianstad, Hässleholm, Linköping, Södertälje, and Arlöv.

The railways themselves have workshops for the *repairs* of stock: some private lines also have works for the manufacture of rolling-stock. There is a Central Repairing Workshop at Örebro for the State railways, these owning ten workshops of varying importance in different parts of the country.



Sleeping-car, State Railways.

The *average speed* of passenger- and goods-trains is comparatively low; on the State lines, for expresses it is 50 km an hour; for ordinary passenger trains, 36 km, and for goods-trains 18 km an hour (1913). The greatest allowable speed for express trains is, at present, 90 km an hour.

Management. Tariffs.

The central administration of the *State* railways is in the hands of the **Royal Railway Board,** which is appointed by the Government, whilst the current traffic and its regulation is managed by five *District Administrations,* the members of which are also appointed by the Government. In connection with the very extensive right of determining matters relative to economic questions conferred on the Royal Railway Board, on the occasion of the last reorganization of that body (1908), there have been placed on that Board two *railway-commissioners* appointed by the Government for two years in succession, who take part in the greater number of the important decisions come to by the Board. There is also a special *superior board of revisors,* consisting of three persons outside of the body of the railway administration and appointed by the Government each successive year for the examination and control of the accounts of the State Railways and of the administration carried out by the Board.

The *private railways,* on the other hand, are managed by Boards appointed by the railway companies concerned, on which Boards, if any public loans or government subventions of any kind have been given, the Government usually has representatives.

Concessions for the construction of private railways are, as a rule, granted by the Government, which also fixes the tariffs for the State railways, as well as for private ones. The ordinary regulations for the general rules of traffic on all railways are also issued by the Government, whilst, on the other hand, the more special service instructions, such as those having regard to signalling, measures of precaution, etc., are drawn up by

the Board of the State railways both for the State and the private railways. In certain matters, the private railways are subject to the inspection and control of the "Väg- och vattenbyggnadsstyrelsen" (Royal Engineering Board; cf. Canals and Waterways). Otherwise no check has been laid by the State on the freedom of action of the private railways, and their lines are worked under financial, as well as administrative, independence. Thus, for instance, the Boards of the private railways have the right to grant, for goods forwarded on their own lines, the privileges and reductions which may seem fit to them. As regards carriage of goods on the State railways, the Board of these railways can under certain conditions grant reductions. As regards goods traffic, these conditions are, chiefly, that the reductions may be made, if they are considered needful and if it be to the economic interest of the State railways to grant the reductions in question.

The network of private railways in Sweden is, as we mentioned before, distributed among a number of different owners. In order to counteract unhealthy competition, there was organized in 1882 a *Joint Traffic Union* (samtrafiksföreningen) of the State railways and a number of private lines, which most of the railways in the kingdom subsequently joined. For goods traffic between the railway lines affiliated to this Joint Traffic Union there exists a common *joint traffic tariff* (tallying with the tariff

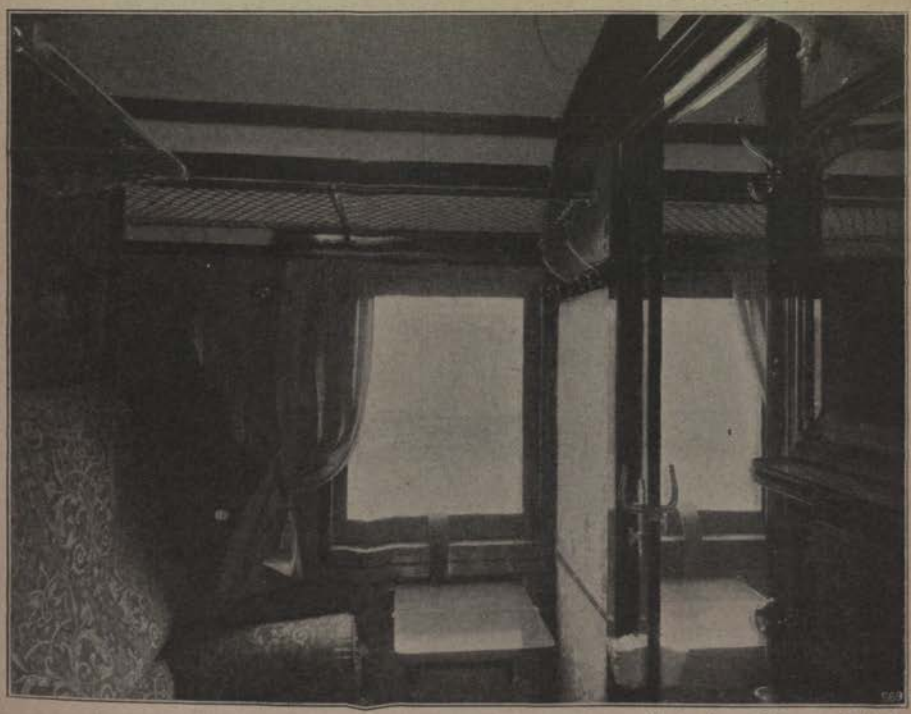


Photo. AXEL SJÖBERG, Malmö.

1st Class Sleeping-car.

of the State Railways, but with certain additional fees), which also gives the rules for determining the routes that are to be employed for the transport of the goods (the *total* line-length forms the basis for determining the tariff employed; cf. below), and for the settlement of any dispute that may arise. The beneficial effects of the work of this union have been felt both by the travelling public and by the railways themselves.

There is also a common tariff existing for the joint passenger traffic between the various railway lines.

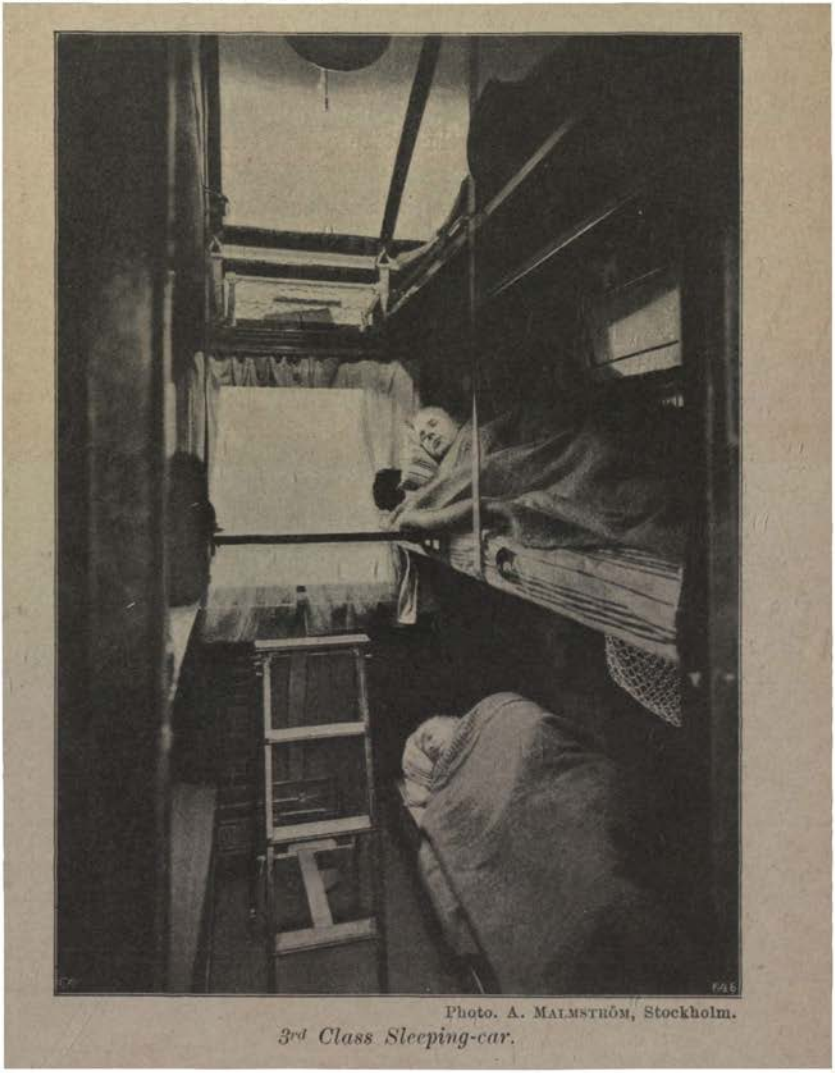


Photo. A. MALMSTRÖM, Stockholm.

3rd Class Sleeping-car.

The *private* railways have a special organization in the *Railway Union* (Järnvägsföreningen), formed in 1876, which embraces nearly all the private railways and is composed of the administrations of these lines. It was mainly through cooperation between this Union and the Board of the State Railways that the above mentioned Joint Traffic Union was founded.

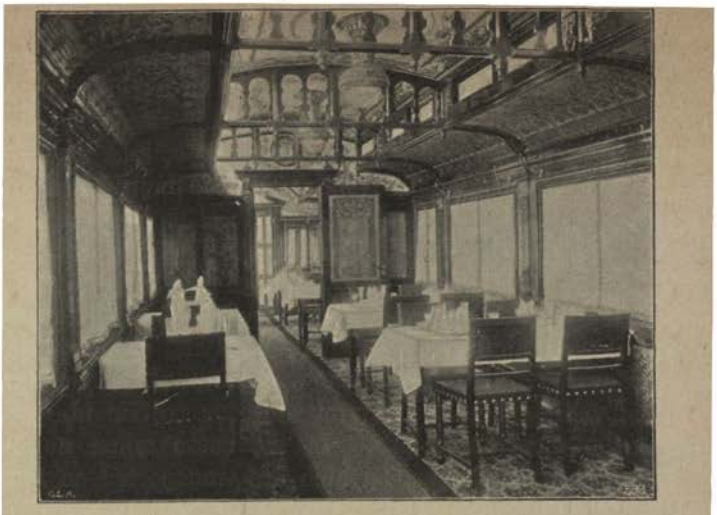
The **tariff** that is in force for the traffic of the State Railways themselves dates from 1889, but since that year it has been revised in essential particulars and is at present being submitted to a thorough re-casting. First, as regards the *goods traffic,* there are certain fundamental principles of calculation for freight-goods, for express-goods, and also for parcels, living animals, vehicles, etc. As freight-goods is included the great ore-traffic from the mines in Lappland. Of the total freight-income for goods on the State lines in 1913, which amounted to 56·6 million kronor, there was received from the Lappland-ore, carriage 13·8 million kronor, from other freight-goods, parcels, and express-goods, 41·4 million kronor (of which amount it was calculated that the parcels and express-goods yielded 2·8 million kronor), while the balance was obtained by the transport of living animals, vehicles, etc. The freight-goods traffic is, consequently, incomparably the most important. In the cases when no special exceptional rates are granted, goods which are transported as freight-goods are classified under the ordinary tariffs, by the assistance of a so-called *goods-classification,* wherein respect is paid partly to the nature and the value, etc. of the articles sent, and also to the size of space occupied by the goods. The goods-classification in force dates from 1902, but includes several alterations and additions of a later date. At the present time, there are 14 different tariffs; the rates are lower the greater the distance, i. e., the freight per km is lower for longer distances than for short ones (for exemple, the freight in tariff 8 is 10 öre for 10 km; 47 öre for 100 km; and 195 öre for 1,000 km; all per 100 kg).

The tariffs for the *carriage of passengers* have been in force since 1906; they are drawn up in accordance with the so-called zone-tariff, according to which also there is an essentially lower rate per km for longer distances

TABLE 126. *Passenger Traffic on the Swedish Railways.*[1]

Annually	Number of passengers In thousands			Passenger-kilometers In millions			Gross receipts of the passenger traffic Thousands of kronor		
	State railways	Private railways	Total	State railways	Private railways	Total	State railways	Private railways	Total
1866—70 . .	1 498	837	**2 335**	77·22	20·51	**97·73**	2 585	727	**3 312**
1871—75 . .	2 524	1 805	**4 329**	127·66	43·20	**170·86**	4 724	1 613	**6 337**
1876—80 . .	3 168	3 741	**6 909**	144·87	90·48	**235·35**	6 158	3 927	**10 085**
1881—85 . .	3 708	4 729	**8 437**	171·44	111·43	**282·87**	7 334	5 031	**12 365**
1886—90 . .	4 240	6 476	**10 716**	188·56	145·70	**334·26**	7 770	6 297	**14 067**
1891—95 . .	5 108	10 408	**15 516**	223·16	220·50	**443·66**	8 636	8 820	**17 456**
1896—00 . .	9 331	16 290	**25 621**	389·23	312·69	**701·92**	14 176	11 654	**25 830**
1901—05 . .	12 454	24 294	**36 748**	515·62	458·22	**973·84**	16 489	15 169	**31 658**
1906—10 . .	17 592	35 356	**52 948**	753·42	677·85	**1 431·27**	21 537	20 571	**42 108**
1911	21 824	38 493	**60 317**	893·02	745·00	**1 638·02**	25 359	23 522	**48 881**
1912	23 134	39 823	**62 957**	968·20	761·48	**1 729·68**	26 925	24 556	**51 481**
1913[2] . . .	24 886	42 497	**67 383**	1027·32	822·11	**1 849·43**	28 544	26 201	**54 745**

[1] Inclusive of the steam railway-ferry routes. — [2] Provisional figures as regards the private lines.



Dining-car.

than for shorter ones. For example, the railway fares for the following distances are as shown as follows:

	1 class	2 class	3 class
up to 10 km	1·00 kr.	0·60 kr.	0·30 kr.
» 100 »	6·50 »	3·90 »	2·60 »
1 000 »	45·00 »	27·00 »	18·00 »

besides wich there is a special additional fare of 2·50, 1·50, and 1·00 kronor for travellers by the express trains, independent of the distance travelled. The employment of this zone-tariff has resulted in a great increase of traffic for longer distances. — For repeated journeys over shorter distances, monthly and book-tickets can be had at reduced rates.

The staff which handles the traffic on the Swedish railways may at present be reckoned at amount to about 50 000 persons, 40 000 of whom have regular or permanent employment. About 28 000 of the above total number are engaged on the State railways. The closest supervision over the employees is exercised by the *superintending staff of the line,* which also controls the safety and regularity of the train service, etc. The nomination and dismissal of employees is — except in the case of high officials on the State railways, who are appointed and dismissed by the Government, — in the hands of the respective Boards, or the authorities immediately subordinate to them, while, with regard to the personnel of the private lines, the Government has not thought fit to fix any general rules for employment except by requiring an examination conducted by specialists as to the applicant's capability of distinguishing between colours.

No general rules are set down with regard to the *length of the working day*; but, with regard to the particularly trying and important service devolving on the train- and shunting-staff, attempts have been made to render the service as

TABLE 127. *Goods Traffic on the Swedish Railways.*[1]

Annually.	Goods carried Thousands of tons			Ton-kilometers In millions			Gross receipts of the goods traffic Thousands of kronor		
	State railways	Private railways	Total	State railways	Private railways	Total	State railways	Private railways	Total
1866—70 . .	479	1 022	**1 501**	57·81	35·34	**93·15**	3 387	2 584	**5 971**
1871—75 . .	1 036	1 998	**3 034**	125·22	62·68	**187·90**	6 713	4 591	**11 304**
1876—80 . .	1 508	3 292	**4 800**	174·44	118·92	**293·36**	9 316	8 801	**18 117**
1881—85 . .	2 119	4 993	**7 112**	226·74	200·68	**427·42**	11 855	13 062	**24 917**
1886—90 . .	2 591	5 929	**8 520**	262·32	246·97	**509·29**	12 523	14 576	**27 099**
1891—95 . .	3 300	8 868	**12 168**	333·40	375·27	**708·67**	14 726	19 611	**34 337**
1896—00 . .	5 897	13 080	**18 977**	658·93	585·36	**1 244·29**	23 757	26 574	**50 331**
1901—05 . .	8 829	16 354	**25 183**	1 056·63	758·04	**1 814·67**	31 459	32 186	**63 045**
1906—10 . .	11 587	21 598	**33 185**	1 384·20	963 34	**2 347·54**	40 402	40 037	**80 439**
1911	13 735	24 318	**38 053**	1 692·30	1 106·03	**2 798·33**	48 046	45 544	**93 590**
1912	15 079	26 349	**41 428**	1 847·42	1 228·25	**3 075·67**	52 799	49 812	**102 611**
1913[2] . . .	16 670	27 037	**43 707**	2 050·52	1 292·97	**3 343·49**	56 558	52 622	**109 180**

[1] Inclusive of the steam railway-ferry routes. — [2] Provisional figures for the private lines.

easy as circumstances permit. With regard to *Sunday labour* on the part of the personnel, reductions have been made in respect to goods traffic, to the extent that neither the receiving nor the delivery of goods takes place on such days; in addition to which, a number of goods trains do not run then. With regard to the staff of the State lines, it is laid down that, as far as possible, the employees are to enjoy leave of absence every third Sunday, so that they may have an opportunity to attend Divine Service. *Night-work*, naturally, occurs both for the

Central Station Buildings, Stockholm.

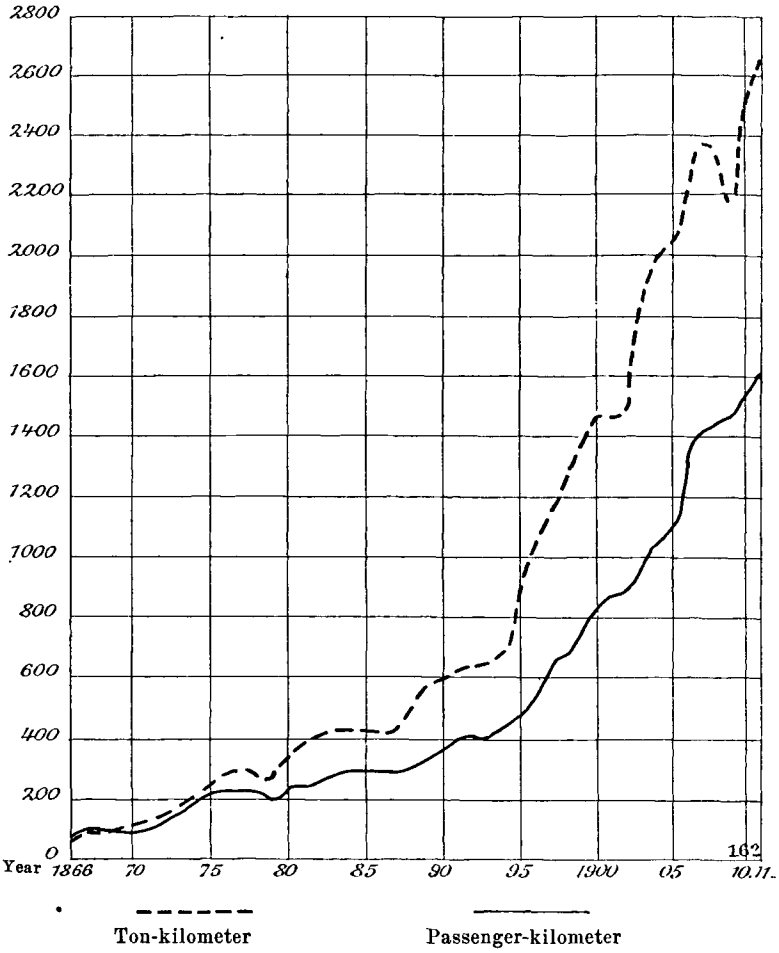
train-, station-, and inspection staffs, on lines where night-trains run. This, however, is chiefly the case as far as concerns the State railways.

The *rates of wages* vary, of course, on different lines and for different kinds of service. In the main, they may be said to equal, or to be higher than, those paid on railways in neighbouring countries. The recent marked increase in the cost of living has, however, led to changes in the wages of the staff. With regard to State railways, such alterations came into operation at the beginning of 1907; and changes in the rates of wages have gradually been introduced on the private railways during the last few years. A signalman or porter on the State railways at present enjoys (including 336 kronor, the estimated value of rooms and fuel in Stockholm, 120 kronor for clothing, and 60 kronor for special expenses in certain localities) not less than 1 356, and not more than 1 656 kronor per annum. A line-man gets, including the same privileges, at least 1 158 kronor and not more than 1 458 kronor per annum. From these wages, however, are deducted the obligatory payments towards pensions. The system of self-help, in the form of Savings- and benefit funds, Life Insurance Unions, and such like institutions has become extremely popular amongst railway *employees* throughout the entire kingdom; and in connection with these, mention should be made of the *Pension institutions* established, which — with the object partly of affording relief for the members themselves in old age, partly as a means of support for those they may leave behind them — are supported by the Public Treasury, in the case of the State railways; and in the case of the private railways, by the lines interested. The pensions of the employees of the State railways are, nowadays, paid direct by the Treasury.

Station in the Provinces (Gnesta).

No railway purely **strategical** lines, have hitherto been built in Sweden, but the project for every proposed new line must be scrutinized beforehand by the General Staff, which has to see that military claims are duly considered. The control of the work for the use of railways for military purposes belongs, in the first place, to the chief of the General Staff acting through a special department for communications, in which department care-

Railway Traffic in Sweden.



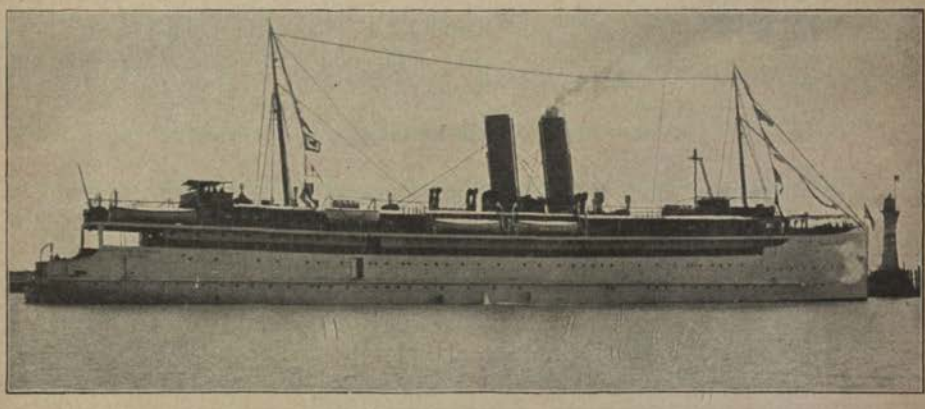
ful plans for making use of the railways in the mobilization, strategical deployment, and concentration of the troops are elaborated. At the field-manœuvres of more or less importance, which take place annually, the railways and their staffs have proved quite equal to the military requirements.

Steam Railway-Ferry Service.

At present, the Swedish State railways are connected with the continent by means of three steam-ferries. Two of these maintain the traffic across the Sound from Hälsingborg to Helsingör, and between Malmö and Copenhagen, while the third connects Trälleborg with Sassnitz, on the island of Rügen. The route *Hälsingborg—Helsingör* was opened in 1892. The

traffic on this route, which is of lesser proportions than that on the other two, is maintained exclusively by Danish ferrysteamers, so that it must be considered as a foreign means of communication.

The traffic by the steam railway-ferry *Malmö—Copenhagen,* which was opened in October, 1895, was at first kept up by Danish vessels alone. Since August, 1900, however, a Swedish ferry-steamer, the Malmö, runs alternately with the Danish boat.



The Steam Ferry-boat, "Drottning Victoria". (Sassnitz—Trälleborg.)

The steam-ferry-boat "Malmö" was built at Kockum's Mechanical Workshop, Malmö. It is 82 meters long, and 16 meters beam, and has a draught of 3·2 meters. It is of 1 514 tons displacement, and the engines develop 1 850 h. p, the maximum speed being nearly 14 knots. The greatest number of passengers the vessel is allowed to carry is 850.

By this route there were conveyed during 1913 a total of 68 907 passengers to or from Sweden; the total number of trips was 3 334, of which the Swedish vessel made 1 704. There were exported 191 803 tons of freight from Sweden, and 43 166 were imported by this route.

The steam-ferry route *Trälleborg—Sassnitz,* Sweden's most important and quickest means of communication with the continent, was established as the result of an agreement made between Sweden and Prussia, on November 15, 1907, and was opened eighteen months later, on July 7, 1909. The traffic on this line is managed in accordance with an agreement between the Swedish State Railways Board and the Prussian Railways Board in Stettin, whereby each of these authorities engaged themselves to convey passengers and carriages once a day regularly in each direction, and, in addition to this, to take turns in carrying out all necessary transport. Two Swedish and two German steam-ferries run daily over the route, which is 107 km long.

On the part of Sweden, the traffic is kept up by the steam-ferry boats, "Konung Gustav V", which has a draught of 3 062 tons gross, and "Drottning Victoria", of 3 074 tons gross. The greatest number of passengers that each boat may carry is 1 800.

Both the Swedish and the German vessels have been built in accordance with the plans drawn by W. Hök, a Swedish engineer, and resemble each other in all essentials. The Swedish boats were constructed, "Konung Gustav V" at Lindholmen's Mechanical Works, Gothenburg, and "Drottning Victoria" at Swan, Hunter & Richardson's dockyard, at Newcastle-on-Tyne. "Konung Gustav V" was built almost entirely of Swedish steel from the Avesta ironworks, while the interior fittings are almost exclusively of Swedish timber. The keel of this vessel was laid on August 19, 1908. It was launched on June 19, 1909, and was delivered, fully equipped, to the Swedish State on March 4, 1910.

The Swedish State was compelled to have the other boat built at a foreign dockyard on account of the short time allowed by the above-mentioned agreement between Sweden and Prussia before the ferry line was to be opened, and, at the time, the home dockyards were unable to do more than to undertake to complete the one vessel within the stipulated time.

Each of the Swedish steam-ferry boats has a length of 113 meters, a beam of 15·6 meters and a draught of 5·0 meters. The engines have a maximum indicated power of 5 000 h. p., and the speed is 17½ knots, i. e., the vessels cover the distance between Trälleborg and Sassnitz in 3 hrs, 15 min., exclusive of the time needed for making fast in the harbours and receiving and discharging the train, etc.

The train-deck permits of a double track amidships, with a total free track 180 meters in length. A total of 18 goods waggons, or a corresponding number of passenger carriages can be carried on each steamer on every journey. The interior fittings of the vessels are exceedingly comfortable and tasteful, even in the parts intended for the 3rd class passengers. The vessels have dining-rooms, smoking-rooms, ladies rooms, bath-rooms, and cabins for 100 passengers. All the bath-rooms are provided with hot and cold water. There are about 800 electric lamps for illuminating purposes, and the heating and ventilation of the vessel is effected by means of heated-air apparatus.

The Trälleborg-Sassnitz ferry-steamers are the largest in Europe, being nearly three times as large as the Malmö steam-ferry boats, and more than twice as large as the Danish ferry-boats on the route Gjedser—Warnemünde. In contrast with other European steam-ferry boats, the railway track does not run through the whole length of the vessels, so that the boats are always obliged to back into the harbour, but this inconvenience is counterbalanced by their being better sea-boats in rough weather. The lines of the steamers are very beautiful, and they are excellent sea-going boats.

On the steam-ferry route Trälleborg—Sassnitz there were carried during 1913, on 2 232 journeys (the Swedish boats, 1 116 trips), a total of 96 802 passengers to or from Sweden, and, during the same time, there were transported 51 866 tons of goods from, and 82 131 tons to, Sweden.

On the ferry-line Malmö—Copenhagen, the greater part of the freight-waggon goods from Sweden to Denmark consisted of timber goods, agricultural products, undressed, key- and dressed stone, iron and steel, etc., while, in the direction from Denmark to Sweden, it consisted of coal, strong fodder, grain, etc. On the Trälleborg—Sassnitz route, the chief freight-goods consist of fish, fodder, wild berries, and stone, while the corresponding consignments to Sweden chiefly consist of oils, machinery, tools and implements, iron and steel, chemicals, and chemico-technical preparations.

Since the beginning of 1912, the vessels on the Trälleborg—Sassnitz

route have been provided with wireless-telegraphy apparatus on the Telefunken system, with a wave-length of 375 meters, chiefly for the transmission of official telegrams, but also for sending private communications. The coast stations are at Trälleborg and Sassnitz harbour, while the vesselstations are the Swedish and the German boats. There were despatched and received private telegrams during 1914, from the wireless station at Trälleborg 50 messages with a total of 943 words, while the steamer-stations had transmitted during the same period 1 040 telegrams with a total of 11 568 words.

Traffic and Finances.

At the end of 1913, the capital invested in all the railways running in Sweden was estimated in round figures to amount to a total of about 1 100 million kronor, which is equivalent to about 77 000 kronor per km. This average figure is lower than that for any other country in Europe. On the average a kilometer of European railway costs something like 320 000 kronor, or quite four times as much as a kilometer of Swedish railway.

The cause of this remarkably low cost of construction in Sweden must, in the first place, be sought in the fact that almost all our lines are still single ones, and, generally, as being calculated for a less heavy traffic than the great main-lines abroad, have been able to restrict themselves to a less extensive arrangement of railway stations and to less rolling stock. A number of other circumstances also contribute to the low cost of construction, viz., that the requisite ground, more especially on the long stretches across Norrland, has often been furnished free of cost by the County Councils, communes, and private persons, and that the construction of lines, with the exception of the above mentioned costly bridges, has been carried out without expensive constructive works.

TABLE 128. *Income and Expenditure of the Swedish Railways.*

Annually	Average length during the years Kilometers[1]			Gross receipts Thousands of kronor			Expenditure Thousands of kronor		
	State railways	Private railways	Total	State railways	Private railways	Total	State railways	Private railways	Total
1866—70 . .	1 047	602	**1 649**	6 051	3 430	**9 481**	3 592	1 721	**5 313**
1871—75 . .	1 299	1 080	**2 379**	11 585	6 403	**17 988**	6 523	3 396	**9 919**
1876—80 . .	1 698	3 045	**4 743**	15 688	13 184	**28 872**	10 498	7 446	**17 944**
1881—85 . .	2 228	4 096	**6 324**	19 420	18 650	**38 070**	11 753	9 768	**21 521**
1886—90 . .	2 513	4 915	**7 428**	20 531	21 509	**42 040**	14 082	11 305	**25 387**
1891—95 . .	2 893	5 752	**8 645**	23 688	29 217	**52 905**	16 427	16 057	**32 484**
1896—00 . .	3 683	6 575	**10 258**	38 354	39 407	**77 761**	25 234	21 899	**47 133**
1901—05 . .	4 038	7 970	**12 008**	49 996	49 834	**99 830**	37 228	30 420	**67 648**
1906—10 . .	4 315	8 944	**13 259**	64 902	66 009	**130 911**	52 519	56 473	**108 992**
1911	4 495	9 400	**13 895**	76 617	74 407	**151 024**	58 610	60 442	**119 052**
1912	4 550	9 485	**14 035**	83 204	79 447	**162 651**	62 909	63 454	**126 363**
1913[2] . . .	4 692	9 570	**14 262**	88 693	85 222	**173 915**	66 867	73 881	**140 748**

[1] Exclusive of some smaller lines, for which traffic-returns are lacking. — [2] Provisional figures for the private lines.

TABLE 129. *Net Revenue of the Swedish Railways.*

Annually	Capital paid up[1] Thousands of kronor			Net revenue Thousands of kronor			Net revenue in % of capital		
	State railways	Private railways	Total	State railways	Private railways	Total	State railways	Private railways	Total
1866—70 . .	82 320	30 980	**113 300**	2 459	1 709	**4 168**	2·99	5·52	**3·68**
1871—75 . .	119 096	53 661	**172 757**	5 062	3 007	**8 069**	4·25	5·60	**4·67**
1876—80 . .	171 001	175 115	**346 116**	5 190	5 738	**10 928**	3·04	3·28	**3·16**
1881—85 . .	215 556	232 407	**447 963**	7 667	8 882	**16 549**	3·56	3·82	**3·69**
1886—90 . .	245 171	256 413	**501 584**	6 449	10 204	**16 653**	2·63	3·98	**3·32**
1891—95 . .	274 622	295 884	**570 506**	7 261	13 160	**20 421**	2·64	4·45	**3·58**
1896—00 . .	329 967	330 697	**660 664**	13 120	17 508	**30 628**	3·98	5·29	**4·64**
1901—05 . .	411 416	436 642	**848 058**	12 905	19 414	**32 319**	3·14	4·45	**3·81**
1906—10 . .	480 385	485 600	**965 985**	12 382	20 282	**32 664**	2·58	4·18	**3·38**
1911	529 036	513 811	**1 042 847**	18 007	25 704	**43 711**	3·40	5·00	**4·19**
1912	544 067	518 734	**1 062 801**	20 295	28 070	**48 365**	3·73	5·41	**4·55**
1913	563 851	526 906	**1 090 757**	21 826	29 565	**51 391**	3·87	5·61	**4·71**

[1] Average for each year (arithmetical means of the figures for the beginning and end of the year) according to book value.

At the end of 1913, the cost of construction of the State railways running amounted to about 580 million kronor and that of the private railways to about 580 million kronor. The cost of the former per km, consequently, comes to about 122 000 kronor, of the latter to about 59 000 kronor. The normal gauge private lines separately cost about 72 000 kronor per km and the narrow-gauge 36 000 kronor.

Data with regard to the extent of the traffic on the Swedish railways are given in Tables 126 and 127, and with regard to the financial result in Tables 128 and 129.

The total **passenger traffic** in 1913 amounted to 129 700 passenger-kilometers per km of railway; on the State railways alone to 218 800, but on the private lines only to 86 000. Only on some smaller distances is the European average (420 000 passenger-kilometers per km of railway) reached or exceeded, this being chiefly due to the sparse population of Sweden, but partly also to the competition with the means of communication by water, so ample in Sweden. Every inhabitant of Sweden travelled in 1911 on an average 295 km, by rail; the corresponding average figure for Europe is 310 km. From this point of view, consequently, the passenger traffic in Sweden is a little below the average. — Of the total number of passengers in 1913 (apart from the transport of troops) 5·0 % travelled 1st or 2nd class, and 95·0 %, 3rd class.

The Goods traffic in 1913 amounted to 234 000 ton-kilometers per km of rail; on the State lines to 437 000 and on the private lines to 135 000. A number of private railways in the mining-districts, however, reach more than 900 000 ton-kms per railway km, and the State railway called the "riksgränsbanan", in the far north of Sweden, approaches 3·4 million ton-kms per railway km, which represents an extraordinarily heavy traffic. The average for European railways is about 600 000. — Of goods carried on the State railways in 1913, calculated according to weight, timber formed 15·6 %, ore 37·2 %, coal 5·5 %,

stones and different kinds of earth, bricks, and asphalt 6·9 %, iron and steel 5.8 %, and grain 3·4 %.

Of *late years*, the goods traffic on our lines has greatly increased, as appears from the accompanying diagram. The ore traffic, especially, has increased in Northern and Central Sweden, and the sugar-beet traffic in the south. A further considerable increase of goods traffic is expected after the installation (in 1914) of electric motor power on the State line Kiruna—Riksgränsen, in the north of Sweden, the traffic on which, from the very beginning, is expected to amount to about one-quarter of the entire goods traffic on all the railways previously existing in the country.

The **financial results** of the Swedish railway industry, of course, varies considerably for different lines, but has, on an average, during the last few years, proved very remunerative, for the entire network of railways. In 1906 the Swedish State railways yielded a net profit of 4·00, but this fell in 1908 to 1·39 %, after which the returns rose once more. In 1912, the net profits were 3·73 %, and, in 1913, 3·87 %. For the private lines the net profits are (1913) 5·61 %. Such a high average is reached by only a few other European countries, the European average being about 4 %. The explanation of this result, so favourable for Sweden, is of course, firstly, the above-mentioned cheap cost of construction, added to which also come the comparatively cheap working-expenses, which, during the last few years, however, have increased considerably.

As to railway **accidents,** we have complete statistics for any great length of time only from the *State lines.* During the period 1856—1905, a total number of 8 *passengers* have been killed through no fault of their own, and 30 passengers have been killed through their own fault. Besides this, 24 travellers have been *injured* through no fault of their own, and 92 through carelessness. 32 passengers have consequently been killed or injured through no fault of their own, and, altogether, 132 have been killed or injured. Of *railway-men* 2 073 have been injured by accidents, 395 with fatal results. As to *other people*, 797 have been injured, 571 of whom have died.

During the year 1911 there were killed on the State railways, in consequence of their own carelessness, a total of 3 passengers. During the same period, 13 railway officials were killed, and 94 were injured. Altogether, 12 passengers were injured in consequence of their own carelessness, and the same number from causes not under their own control. On an average for the years 1906—10, the number of accidental deaths amounted to 11 passengers, 120 railway officials, and 39 persons that should not have been on the line, or a total of 170, which is somewhat less than 8 persons per one million train-kilometers.

If we examine the statistics for the private railways, the latest returns for which are for the years 1911, we find that 114 persons met with accidents on them during the period in question. 10 passengers were killed and 4 were injured. 13 railway officials were killed and 50 were injured. 27 other persons were killed and 10 injured.

Per million train-kilometers, therefore, during 1911, the number of killed on the private railways was 1·63 and the total number of injured 2·09.

The above figures for the net profit demonstrate that Swedish railways produce a fairly large profit, from a purely business point of view. As regards the *indirect* results of the Swedish railway industry, this cannot be easily illustrated by exact figures, but beyond doubt the marked development of the national resources of Sweden during the last few decades is closely connected with the building and extension of the railways of the country, which have also powerfully counteracted the economic and

social isolation which the long distances have always tended to establish between the various parts of this vast but sparsely populated country.

Electrification of the Swedish Railways.

Sweden suffers from an almost total dearth of native locomotive fuel of fully satisfactory quality, but, on the other hand, it has rich resources in its waterfalls and peat-bogs. The question of the utilization of the waterfalls, especially, for obtaining motive-power for the State Railways has, consequently, been under consideration for a considerable number of years, and since it has now proved possible to transmit electric energy over great distances, the question of the electrification of certain sections of the State railways, where a lively traffic is carried on, has now been taken up.

The Railway- and Transformer-station at Abisko (Kiruna—Riksgränsen).

On the basis of the investigations carried out during the years 1902—09 by the State Railways Board, partly from an economic point of view, and partly by means of practical experiments on one or two short-distance sections in the vicinity of Stockholm, the Riksdag of 1910 resolved to devote an amount of 21 500 000 kronor for the electrification of a section of the railway, about 100 km in length, between Kiruna-Riksgränsen.

The reason why it was considered that this section of line, which is situated far north of the polar circle (at 68° latitude in the regions of eternal snow, almost at the same degree of latitude as Alaska), should be dealt with first was, partly, that at the period in question this section of the State Railways had the largest regular traffic of the whole of the State railway system, and also the circumstance that it would be necessary in the immediate future to make a considerable increase in the traffic-powers of this section, in consequence of the growing transport of ore, concerning which an agreement had been entered into between the Swedish State and the Mining Companies concerned. The work, both as regards the installation of the power-station and also with regard to all the other details required by the electrification of the section of line in question, is now being carried out and it is expected that the line will be opened for this traffic in the beginning of the year 1915.

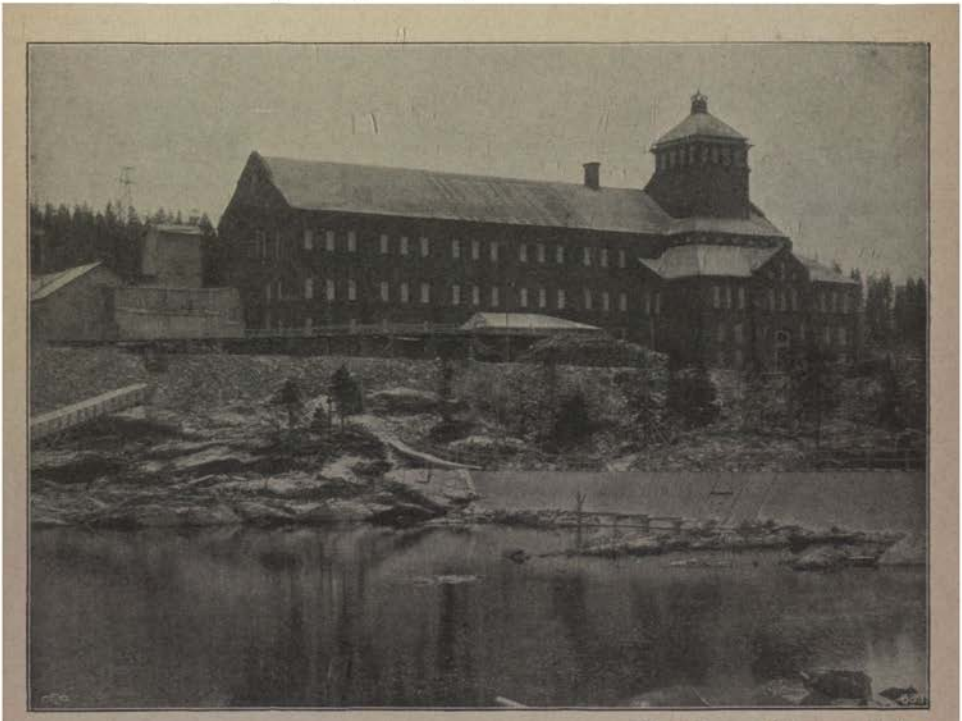


Photo. LUDVIG WÄSTFELT, Porjus.

The Power-station at Porjus, Lappland.

The electric power will be obtained from the Porjus waterfalls, in the river Stora Lule älv. These falls consist of four separate falls, of which the largest is the so-called Routikårtje, which consists of two waterfalls lying one immediately below the other.

The engine-room of the power-station in which, for the electrification of the line, there are being mounted turbines of together 50 000 h. p., and made for a tension of about 4 000 volts, consists of a chamber blasted into a hillside and

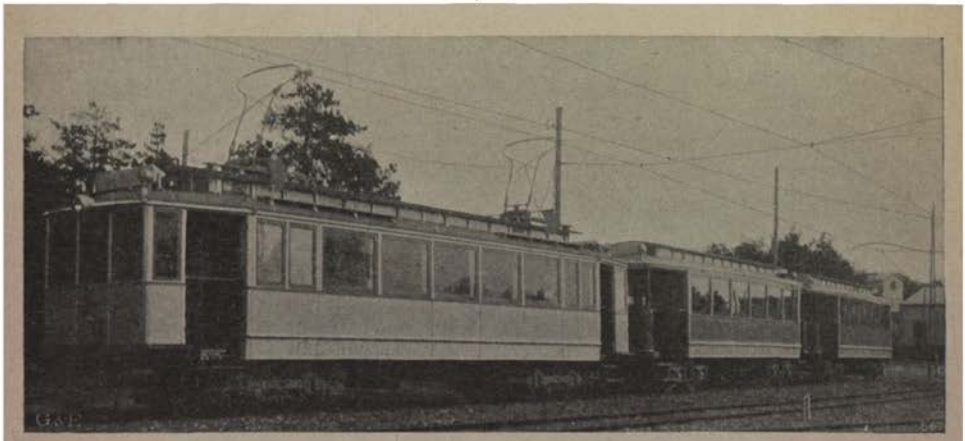
lying 50 meters below the surface. The feed-tunnel for the mass of water is 600 meters long, and the discharge-tunnel, 1 200 meters long, both of them blasted out of the rock.

The line-transformers which are placed in the transformer-regulation house transform the tension up to 80 000 volts. In four transformer-stations, arranged at different places along the line, the tension for the contract wires is reduced to 16 000 volts. The transmission-wires are supported on 3-legged iron pillars about 20 meters high and at 200 meters span.

The contact-wires, which are also suspended on iron-posts and have a width of span of 52—60 meters, have special automatic tension-devices, tested by the Swedish State lines in order to obtain a constant tension.

The locomotives are of two kinds, viz., ore-train- and express locomotives. The ore-train locomotives, which are built as double locomotives, are 8-axled, in consequence of the axle-pressure for the line amounting to 17·5 tons. They weigh 140 tons, develop 1 700 h. p. and have a traction-power of 15 tons. The express-train locomotives are intended for a train-weight of 200 tons and can attain a maximum speed of 100 km per hour. Every locomotive of the first-named class can cover 90 000 km without overhauling, while the locomotives of the last-named class can cover 100 000 km, in each case per annum.

The electric installations for the line-section Kiruna—Riksgränsen have been carried out by the Allmänna Svenska Elektriska A.-B., of Västerås in conjunction with the Siemens-Schuckert Werke, in Berlin.



Electric Train; Hälsingborg—Råå—Ramlösa Railway.

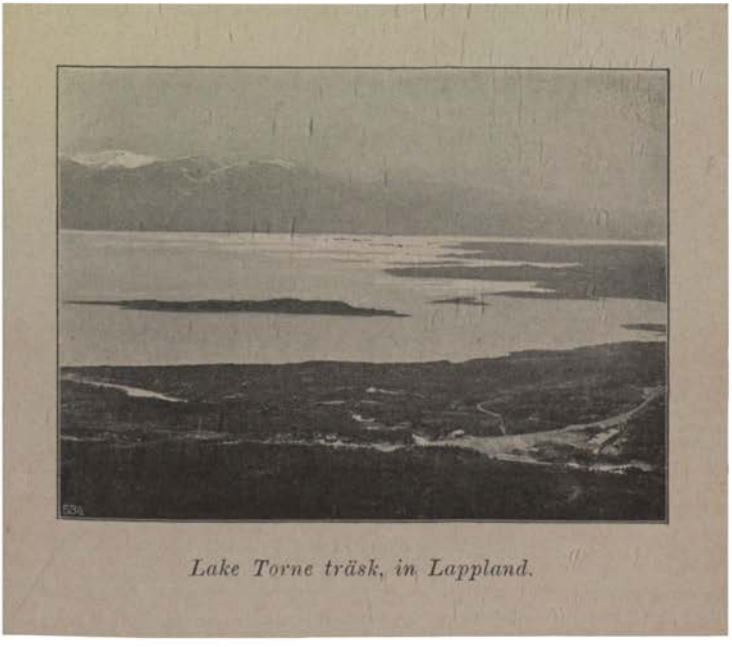
Among the private railways, there was for a long sequence of years only one on which electric power had been introduced. This was the Stockholm—Roslagen Railway Company, which, at the beginning of the nineties, began the electrification of the line-section between Stockholm and the borough of Stocksund and the town of Djursholm. The power-station is situated at Stocksund. The line-section in question, with its branch-lines, is 16·0 km long and, for Swedish conditions, has a very considerable passenger-traffic.

Ten years after electric motor-power had been introduced on the so-called Djursholm line, was constructed the Hälsingborg—Råå—Ramlösa railway, which was provided with electric motive-power. This line, which

is intended both for passenger- and goods-traffic, is about 7 km long and connects the town of Hälsingborg with the fishing-village of Råå and the watering-place of Ramlösa. On this line, too, there is considerable passenger-traffic, which, in the years immediately succeeding the electrification of the line, was increased by 50 %.

The electric railways between Gothenburg and the seaside-place of Långedrag (5 km), and that at Lidingön (about 4 km), are to be considered more as continuations, the former of the Gothenburg tramway, with which it is, too, to be altogether united, so as to form one company, and the latter of the Stockholm tramway system, which runs its trams over the line in question. The Stockholm—Saltsjön (Saltsjöbaden) Railway (15·2 km) is electrificated since 1912, 13.

The above mentioned lines and line-sections have been built for service with continuous current. As we mentioned above, however, experiments with good results have been made on the State Railways with the employment of one-phase, high-frequency, alternating current; a number of private lines have also directed their attention to this system. Hitherto, however, only one private railway has introduced electric trains with such currents as the motive-power, viz., Mellersta Östergötland Railway on the 8 km long line-section, Klockrike—Borensberg. The power is supplied from the Motala Ström Kraftaktiebolag's station at Nääs.



Lake Torne träsk, in Lappland.

2. URBAN COMMUNICATIONS.

The enormous development of the population, administration, and industries of the large towns has brought about a corresponding development in their means of internal communication, which constitutes one of the most characteristic features of the present day. As Sweden possesses only two or three large towns, these even being of comparatively modest dimensions, there has not, of course, been much opportunity for rivalry in this respect with the cities of more populous countries, but, in proportion to the population and traffic, the means of communication existing within the three chief towns of Sweden are fairly well developed, while, in a large number of other towns of the second rank, the internal communications have been relatively well provided for.

First, as regards the railway lines running into the towns, it is only within the last decade or two that this means of communication has been employed to satisfy the demands of local traffic. It has been the emigration to the suburbs and the so-called "villa-communities" around the larger centres of population — chiefly Stockholm — which has sprung into being during the period mentioned, that has occasioned the local traffic, a traffic which has developed enormously during the last few years.

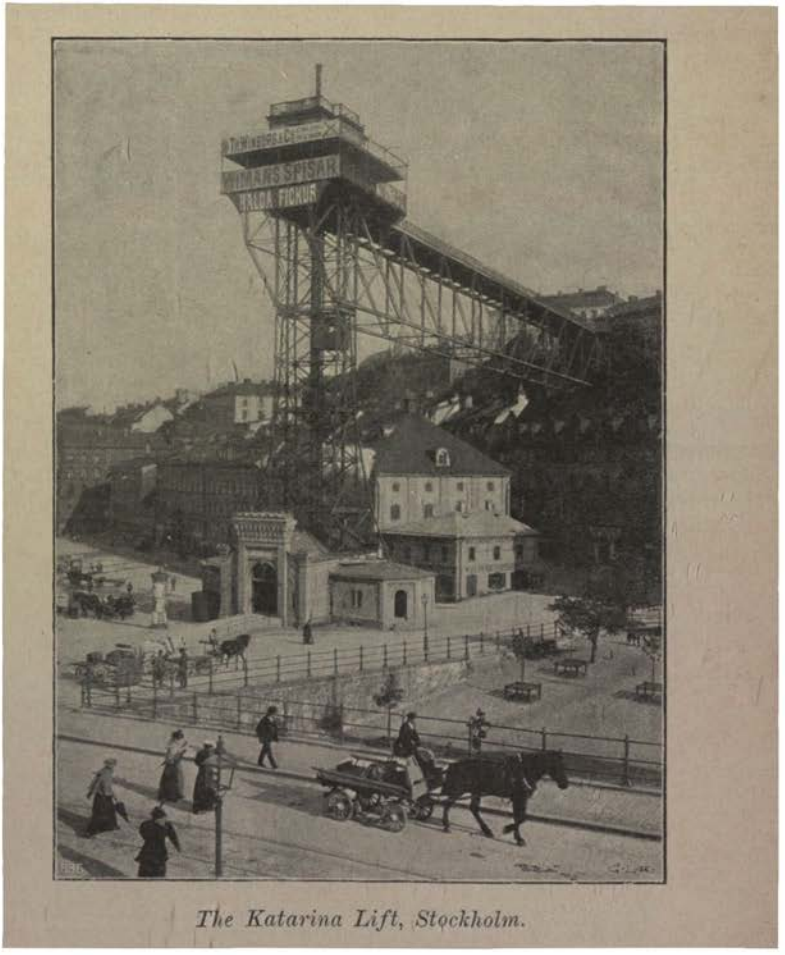
As regards **Stockholm,** where, from many co-operating circumstances, the growth of suburban traffic has been specially rapid, it was the Stockholm—Västerås—Bergslagen Railway that first commenced the traffic in question, viz., by the line between Stockholm and Sundbyberg. An extensive local service afterwards arose both on the State Railways, northwards and southwards, and on the Stockholm—Roslagen lines to the north-east. The Stockholm—Saltsjön Railway, which was built in consequence of the rise of the seaside resort of Saltsjöbaden, has an immense traffic nowadays. The two lines of railway last mentioned — of which the suburban traffic of the first has, for a long time back, been carried on by means of electric trains, while the latter has been electrified during the course of 1913 — have had the number of their passengers considerably increased by the fact that the centres of certain branches of sport, winter-sport especially, are the two places, Djursholm and Saltsjöbaden,

TABLE 130. *Statistics Concerning certain Suburban Lines, in 1912.*

Railway	Constructed in	Length km	Cost of construction kr.	Receipts 1912 kr.	Expenditure 1912 kr.	No. of passengers 1912
Stockholm—Nynäs	1901	55·4	5 482 000	556 000	359 000	461 000
Stockholm—Djursholm. . .	1893	16·0	3 795 000	554 000	374 000	1 913 000
Stockholm—Saltsjön. . . .	1893	15·3	3 452 000	578 000	457 000	2 015 000
Gothenburg—Särö.	1903—04	24·4	1 924 000	228 000	176 000	635 000
Malmö—Limhamn	1889	5·0	924 000	198 000	135 000	784 000
Hälsingborg Råå Ramlösa	1891 (1906)	8·5	1 621 000	225 000	120 000	526 000

which are situated, one on each of the lines in question. The extent of the traffic on the suburban lines during 1912 (the latest year for which statistics are available) is seen from Table 130. The local traffic on main railway lines showed the following number of passengers in 1912:

Stockholm—Södertälje	2 710 000
» —Värtan	7 000
» —Väsby	994 000
» —Stäket and Riddersvik	4 207 000



The Katarina Lift, Stockholm.

The tramways of Stockholm, which embrace two systems, viz., one for Södermalm — the south of Stockholm — and another for the other parts of the city, have considerably developed during the last few years, as is clearly shown by the appended table. Both systems now employ electric power. The northern system, which is the property of the Stockholm Nya Spårvägs Aktiebolag, not only has lines within the town but has also a branchline outside, viz., that running via Hagalund and Råsunda, out to Sundbyberg. The same tramway-company runs trams on the line from Kungsholmen into the Bromma district, which is the property of the city of Stockholm and is intended for industrial establishments. The tramway-company in question also runs its cars on the

TABLE 131. *Statistics of the Tramway Traffic in Sweden, in 1912.*

Tramway	Constructed in	Length km	Cost of construction kr.	Receipts 1912 kr.	Car-kilometers 1912 kr.	No. of passengers 1912
Stockholm municipal tramway (Bromma)	1912	1·8	163 000	27 000	102 000	421 000
Stockholm Northern tramways	1877 (1904)	34·7	17 280 000	5 318 000	11 515 000	58 843 000
Stockholm Southern tramways	1886	11·2	538 000	1 006 000	2 242 000	10 896 000
Lidingö tramways	1907	3·2	[1]948 000	73 000	189 000	831 000
Southern suburban line .	1911	8·5	380 000	102 000	270 000	1 049 000
Gothenburg tramways . .	1902	32·4	5 112 000	2 108 000	6 168 000	24 004 000
Malmö tramways	1906	15·9	2 562 000	741 000	2 262 000	7 654 000
Sundsvall tramways . .	1910	7·1	600 000	107 000	330 000	1 076 000
Norrköping tramways . .	1904	6·7	497 000	169 000	751 000	2 033 000
Uppsala tramways . . .	1906	7·0	254 000	143 000	520 000	1 404 000
Gävle municipal tramways	1909	5·5	567 000	118 000	625 000	1 136 000
Hälsingborg tramways . .	1903	5·4	533 000	137 000	602 000	1 511 000
Jönköping tramways . . .	1907	3·8	453 000	122 000	458 000	1 215 000
Karlskrona tramways . .	1910	3·5	269 000	60 000	176 000	575 000

line on the island of Lidingö, which is the property of the Lidingö Trafik Aktiebolag.

The Södra spårvägsaktiebolaget, Southern Tramways in addition to its lines in Södermalm, also owns and works a line from Skanstull, past the Municipal Slaughterhouse, to the Egna Hem ("Own Homes") Colony at Enskede, another suburb which is the property of the town.

In the commune of Brännkyrka, which is now incorporated with the capital, there is an independent tramway line which starts from Liljeholmen bridge and ends at two termini, Midsommarkransen and Fridhem, which are also the last stations on two branch-lines.

The total number of passengers carried during 1912 on all the tramway lines in and about Stockholm is shown by Table 131.

A characteristic feature of the means of communication within Stockholm is the numerous fleet of *little steamers* that, for many decades, have kept up a lively traffic on the many waterways of the capital. During the last few years, however, the competition of the tramway lines has checked the further development of these boats. In 1911 there were engaged in the traffic within Stockholm and its immediate neighbourhood 64 steam-boats and ferries, each of which, on an average, could accommodate 123 passengers. The number of trips daily is, on some lines, exceedingly large, and the total number of passengers amounted in the year named to 11 704 000. In addition to this, there is the considerable traffic carried on by passenger-steamers to the little centres of population on the islands of Lidingö and Värmdö, to Saltsjöbaden, and to a large number of places on the shores of Lake Mälaren and the Baltic; the number of passengers on these boats can be estimated at, at least, $2^1/_2$ millions per year. — The hilly character of Stockholm has led to the introduction of a peculiar means of communication in the three *elevators* or *lifts* to Södermalm (the Katarina- and Maria-lifts and the lift at the Söderberg stairs) which, during 1911, conveyed altogether 2 202 000 persons. There is also the Brunkeberg tunnel, a means of communication under the hill called Brunkebergsåsen (formerly ca. $1\ ^1/_3$ million foot-passengers yearly; now sinking on account of new streets being opened for traffic; 1914 ca. $^2/_3$ million). — Since the extension of the tramway

lines outside the area of the town proper, the omnibus-traffic that once existed has almost entirely disappeared.

Gothenburg, the second city of Sweden, has, like Stockholm, during the course of the last few years, obtained good local communications. Of the railways running into the city, it is chiefly the western main-line that has any considerable suburban traffic. In addition, the Särö railway-line — which was constructed chiefly for the convenience of the citizens of Gothenburg that go to the local seaside places during the summer — has a considerable amount of local traffic, as may be seen by Table 131 above. *The tramway traffic* has rapidly attained an unexampled development, since the town, some years ago, took over the management of the lines, which had hitherto been in the hands of an English company. The length of the lines and the extent of the traffic is shown by the appended Table. In this town, too, the tramway lines have been carried beyond the municipal boundaries, to Kviberg (a military centre) and Mölndal, and also to Långedrag, a seaside- and sporting-resort. There is also a good service of ferry communications between the banks of the river Göta älv, which flows through the city.

Malmö had horse-trams at a comparatively early date but, in 1906 the system were electrified, and the lines very considerably extended. With one exception, the lines lie within the municipal boundaries, and only one line, running southwards, viz. that to the Fridhem district near Limhamn, lies outside the town. To the last-named place, which in future (1915) will be incorporated with Malmö, there runs a suburban railway (Malmö—Limhamn Railway), which, in proportion to its length, has the largest passenger-traffic in the whole of Sweden. Other railway lines running into Malmö, the State lines especially, enjoy an extensive local traffic, for, in the neighbourhood of these railways, there lie several large suburban communities, the chief of which is the manufacturing centre of Arlöv.

There are also tramway lines in the following Swedish towns: *Gävle, Hälsingborg, Jönköping, Karlskrona, Norrköping, Sundsvall,* and *Uppsala,* some of the lines being carried to the larger centres of population lying near the towns mentioned. The length of the lines and the extent of the traffic are shown by Table 131.

3. COUNTRY ROADS,

At the end of 1912, Sweden had 62 526 kilometers of **country roads** or, on an average, 15·2 km per hundred square kilometers of its area. In the six most northerly läns, there were, however, only about 5·5 kilometers of country road per hundred square kilometers, whereas in the middle and southern parts of the country, the corresponding figure amounted to 34·3 kilometers. For the Län of Malmöhus, the proportion rises to 66·2 kilometers of country road per hundred square kilometers, but, in the Län of Västerbotten, is no more than 5·0, and in that of Norrbotten only 2·7.

In a thinly populated country with a configuration so broken as that of Sweden, the construction of roads between the farms and village communities, and the keeping of these roads in repair, has always been a heavy burden on the people. For this reason, it was not possible in the earliest times and during the whole of

the Middle Ages to get anything but a small number of roads constructed that were practicable for vehicles. The "Eriksgata", i. e., the road used by the newly elected king when making his progress to receive the homage of his people, formed a circuit through the central parts of the kingdom, running round Lakes Vättern and Hjälmaren and the western part of Lake Mälaren. But even this road was in old times certainly nothing but a bridle-path. From various points of that "Eriksgata", roads branched off towards the surrounding parts of the country, e. g., one south-eastwards to Kalmar, one south-westwards to Halmstad, a westerly one to the estuary of the Göta älv, a north-westerly one to Kopparberget in Dalarne, and a north-easterly one to the coast of the Gulf of Bothnia. In the time of Gustavus Vasa, it was decreed by the Riksdag of Västerås (1544) that all public roads should be cleared by the help of the common people and at their expense, "so that all the roads might be passable without any risk, both from Ny-Lödöse (now the Gamlestad of Gothenburg) towards Kalmar and thence to Stockholm, this should likewise be done with all the other roads necessary"; further, that the peasantry of Northern Västergötland should "clear the Tiveden forest (between the provinces of Västergötland and Närke), so that people might easily pass along it with vehicles". In spite of this, it is rather unlikely that a road passable by carts was really constructed across the Tiveden. Far into the 16th century, assemblies of importance were almost exclusively held in towns that could be reached by boat. According to a descripton still extant, written by a German traveller about his journey from Hälsingborg, via Jönköping and Norrköping, to Stockholm, in 1586, the way was in winter-time generally laid across frozen lakes and level country, whereas in summer the route by water was preferred, "for", he says, "because of the deep roads and the marshy lands it is difficult to make one's way on horseback".

But, from time to time, arrangements were made to improve the roads. In 1664, it was enacted that all thoroughfares between towns, parishes, and the courts of assizes should be improved, in some places they were to be altered, levelled, and straightened. With this object, the roads were divided into various sections to be kept "well cleared and in good repair", by the peasantry; at the same time an ordinance was issued concerning the survey of the roads and the erection of mile-posts. Nevertheless, at the end of the 18th century there existed but few carriage roads except the highroads, and, on the whole, it was not till the 19th century that the roads of Sweden were put into a condition comparable with their present good state. In Skåne, *S. G. von Troil,* Governor of Malmö (1851—74), made himself famous for his successful efforts for the improvement of the roads.

Since 1840, the State has, to a steadily increasing extent, made grants towards keeping the roads in a good condition. In the year mentioned, grants to the amount of 75 000 kronor were made "for the laying out of new roads, or else for the improvement and reconstruction of hilly and less satisfactory roads"; moreover, the people in the neighbourhood of such roads were enjoined to contribute towards the costs of construction, as well as to undertake their future maintenance. The State grant has ever since constantly been on the increase, so that in 1915 an amount of 3 million kronor is to be allotted to the purpose. By those means some 19 250 km of road has been constructed or improved between 1841—1913.

The construction of *new roads* has of late chiefly been carried on in the north of Sweden. During 1841—1913, State grants of 36·16 million kronor have been made towards the construction of new high-roads and the repair of old ones; the total calculated cost of these roads amounts to 54·82

million kronor. Out of the State grant, more than 4·5 million kronor have fallen to each of the läns of Norrbotten and Västerbotten. Of late years, the share of Norrland has still further increased, so that for 1909—13 an amount of 2 950 000 kronor fell to the four northernmost läns out of a total of 7 200 000 kronor. — In several läns the County Councils also make grants towards the construction and improvement of the roads.

Conformably to old legal enactments, the roads were **divided** into four kinds: high-roads, which, had to be 6 meters wide, church-roads and mill-roads, which should be 3·6 m wide, and market-roads. In the 18th century, there was also a difference made between court- or hundred-roads — joining two hundreds and their courts of assizes — and parish-roads, comprising the former church- and mill-roads; less important were the village-roads, which had to be kept in good repair by the respective villages. During later times, the public roads were classified into high-roads or king's highways, hundred-roads and parish-roads. The law of 1891 concerning roads, which has been in force since 1895, makes no other difference than between *high-roads* and *village-roads*. 1912, there were 19 049 kilometers of high-roads and 43 477 kilometers of village-roads, to which may be added the 800 kilometers of town streets, which are considered as forming part of the net of roads in the Kingdom.

The task of **keeping the roads** in repair has, in Sweden, ever since olden times fallen on the land, i. e., on all those persons who owned and cultivated the ground, and so the burden was, at quite an early date, distributed upon the farms. Only the construction and repair of large bridges was made the joint business of one or more hundreds.

Many runic stones from the time of the Vikings commemorate men who had built roads or bridges. And the fact that the Church — though, in general, she had her land exempted from contributions as far as possible — constantly took part in the repair of the roads that ran by or through her estates, bears witness to this work being considered as highly important for civilization and for the interests of the Church, and also to the fact of its being too heavy a burden to be borne by the assessed land alone. The expedient, resorted to in many places abroad, of finding means for the repair of the roads by levying a fee from the way-farers, has been practised in Sweden only to a small extent, and then chiefly at large bridges, for the construction of which the communes or the hundreds had been obliged to raise a loan repayable over a long amortization period.

For many centuries, the repair of roads has been incumbent only on the assessed land, i. e., on the farm-owners, but with the exemption of certain farms, works, mills, taxed outlying grounds, and the country parsonages of town clergymen; the properties with special privileges (Säterier) in Bohuslän, Halland, Skåne, and Blekinge — provinces ceded by Denmark to Sweden in 1658 — were also dispensed from road-service. Previous to 1895, the hundreds had to keep up the highroads and hundred-roads; each parish kept its parish-roads; and each town, the roads within its own boundaries. After many complaints about this burden, the road-service was finally placed on other taxable objects than landed estates by the **Law about Roads, of 1891.** Since 1895, a certain tax has been levied on

each "*vägfyrk*", and, since 1906, one such "fyrk" (taxation-unit) is levied on landed estate (common woods excepted) for each 100 kronor of the assessed value, on common woods for each 150 kronor of the assessed value, on other real property, for each 200 kronor of the assessed value, and on income of capital or work, for each 30 kronor of the assessable share. Small parcels of land, and the income from State tenement lands are, however, exempt from sharing the burden of road-service.

The keeping of the roads in repair is performed in kind by those who possess landed estate, with the exception of common woods, and all the roads of each **road-service district** are divided among them according to the assessed value of their farms. The road-service district generally corresponds to the hundred. Of the amount required for maintaining the roads of the whole district, the State contributes $^{3}/_{20}$, while the remaining $^{17}/_{20}$ are distributed between all the "vägfyrks" (see above) of the district and paid in money into the road-fund by those who have not already paid their road-tax in kind. With these supplies the road-fund must pay the cost of the *non-divided* roads, bridges and ferries, the winter upkeep (snow-ploughing), administration, road- and bridge constructions, and more casual expenses. If the money does not suffice, additional sums must be levied in money on all the "vägfyrks". If, again, a surplus remains, this can be used for a thorough repair of the roads, or, if this be not required, for an alleviation of the road-service (abatement of the taxes for the following year). The State also shares the cost of (the first) partition of roads, or their "gradation" (valuation) and distribution among those having to do road-service in kind, which is carried out in the same way as the division of lands During the last few years, the State has made grants to those road-service districts that are heavily burdened. In 1913, this grant amounted to 150 000 kronor. Other duties connected with the administration of roads devolve on a *Board of Roads*, chosen by the roadkeepers of each district, and are controlled by an annual *road-survey*, carried out by the officials bound to keep order in the country districts, with the assistance of two jurats (nämndemän).

In 1912, the kingdom was divided into 370 road-service districts. The cost of upkeep for the "divided" roads was then estimated at 7 550 000 kronor, or on an average, 12·07 kronor per road-meter. The expenses of the *non-divided*, roads, bridges, and ferries came to 1 545 000 kronor; of the winter upkeep, 1 253 000 kronor; of administrative expenses, 286 000 kronor; of road- and bridge constructions, 2 423 000 kronor, and of other items, 645 000 kronor, or a total of 13 702 000 kronor. Of this sum, 11 080 000 kronor fell on the different road-service districts, the rest being paid by the State.

During the last few years, however, vigorous appeals have been made to the State to undertake the entire charge of the road-service, and numerous motions have been brought forward in the Riksdag to this effect.

The *towns* must keep their roads in repair themselves and by their own authorities superintend those who have to maintain the road-service (land-owners, contractors, or hired workmen). The upkeep of *village roads* depends on the agreements made between those who use them, and disputes are, as a rule, settled at the courts of justice, on equitable grounds.

The character of the country roads in Sweden has improved considerably during the last few years, and in general, they may be considered as satisfactory, excepting in some districts, especially in the north of Sweden. With the arrival of the motor-car, there has grown up during the last few years an increased need of improved country-roads, and a "Road Association" is just now being formed (1914), the object of which is to work for the development and improvement of the roads in question.

On the high-roads, there exists a regular **posting system,** so that travellers can be sure of getting a horse and carriage against fares fixed by law. The total number of *posting stations* amounted at the end of 1910 to 1 512, the average distance between them being about 25 kilometers. On an average, a conveyance with one horse costs 18 öre per kilometer, but the cost varies considerable at different stations. An institution that, since far distant times, has been connected with posting is that of **country inns.**

In the earliest times, nearly every traveller drove his own horse and tried to get night-quarters with the clergymen or the peasants; and time-honoured hospitality, was willingly granted — with or without payment — to wayfarers. But with the rising power of the gentry and the clergy, their claims on the generosity of the peasantry also grew, and, as early as in the 13th century, taking by violence from the peasant what he did not give voluntarily (so-called forced quarters) had become so common a custom that legislation had to interfere. By an ordinance issued at Alsnö about 1280, king Magnus Ladulås forbade the taking of forced quarters, and it was enacted that in every village there should be an **innkeeper** or farm-steward, who, against reasonable payment and under strict responsibility, was bound to provide wayfarers with what they required. Among those who travelled on State business it became more and more customary during the Kalmar Union (1389—1523) to enjoy food and lodgings gratuitously, and king Gustavus Vasa (1523—60) sanctioned by law the **transport for the Crown,** i. e., the duty of the peasants to convey gratuitously, the royal family and members of the Court (king's post), troops and military munitions (transport for the Crown, proper), and prisoners (prison post). Modifications in the duty of transport for the Crown were often proposed, but it was not until 1689 that payment was stipulated for all kinds of transport for the Crown, with the exception of prison post, which continued to be carried on gratuitously until 1734.

During all this time, the institution of country-inns had been dealt with by several ordinances. In 1561, a tax was imposed for the establishment of country inns, where horses had to be kept in readiness to be hired against a fixed rate of payment by those travellers who were not entitled to be conveyed by Crown post. In 1584, it was enacted that the country Constables should also be innkeepers; a scale of payment was drawn up for victuals, fodder, etc., and the innkeeper was granted exemption from taxes on his farm. In 1593, a fixed rate of posting charges was for the first time prescribed for all travellers. During the 17th century, the establishment of country inns at distances of, at most, 2 Swedish miles (about 12 Eng. miles) from each other, was encouraged by granting several privileges and advantages to the owners; e. g., assistance from the hundred in building the house, grants of parcels of land out of the commonlands, exemption from taxes, and the monopoly within a certain district of selling beer, wine, and spirits.

According to the inn-regulations of 1734, the governor of the län had to decide where inns should exist, and the farms were bound to undertake their upkeep, etc., in return for privileges fixed by law (innkeepers' privileges). But at the same time **the duty of keeping a relay of post-horses** continued to be a considerable burden. As early as 1633, Crown-tenants and farmers that lived at some distance from the high-roads were enjoined to have horses in readiness at the disposal of the innkeepers (constables) for 4 days at a time (tenants of the nobility only for 2 days). As soon as these horses were taken, notice was given for as many more as were needed to be sent by

the people in the neighbourhood of the inn (so-called reserve post). In 1727, an endeavour was made to get the uneven distribution of this burden equalized by agreements entered into at the assizes by means of so-called "post-relays", which had to divide the duties within their districts according to settled principles. In general, the posting charges were, no doubt, too small a remuneration for the trouble of keeping post-horses, for which reason the discontent and complaints never ceased. At last, in 1810, the work was let by *contract* when possible; horses were to be held in readiness against a higher rate of payment and with the aid of a public grant. As a rule, the innkeeper himself, or a peasant living in the near vicinity of the inn, became the contractor; but when the number of horses he had undertaken to keep had been taken, the obligation of the farm-owners to provide reserve horses when wanted was once more enforced.

By the **Statute of 1878** on posting, the land has been nearly entirely relieved from the above-mentioned "burden". The hire per mile is fixed for each län by the Government on the proposal of the Governor and the County Council, but if, at the auction, the lowest amount for which a solvent contractor will undertake to keep post-horses prove to exceed the hire, the State pays half (in certain cases somewhat more) and the County Council grants the rest, which latter contribution is laid not only on the landed property that formerly had to bear the posting burden alone, but also on other property or income. However, by lowering, or refusing to grant, the contract contribution demanded, when it is thought too high, the County Council can compel a return to the old system of reserve post. Further, the law in question annulled a great many dispensations from the duty of assisting in the maintenance of the posting service that had been granted to several kinds of farms, benefices, and official posts. Nevertheless, the obligation still partly remains of transport for the Crown against a stipulated payment, differing in times of war from that given in times of peace, and varying also for different kinds of farms. However, nowadays this burden is imposed only exceptionally, as the very numerous railway lines of Sweden render less and less the necessity of posting, both for private people and still more for military purposes. — Of the decrease in public posting, the figures below bear witness; they show the annual number of post-horses sent out during the quinquennial periods, 1856—1910:

1856—60	948 000	1886—90	204 124
1861—65	621 309	1891—95	232 280
1866—70	416 245	1896—00	316 212
1871—75	585 084	1901—05	359 015
1876—80	379 234	1906—10	403 409
1881—85	255 853		

During the last period, the number has increased again. The cause of the decrease is, in several places, probably the high posting rates, in consequence of which it sometimes proves cheaper to hire private conveyances.

Of the 1 512 *posting-stations* that existed in 1910, the posting was carried out at 1 376, or 91·0 % of the whole, by being let to *contractors*. In 1880 the

corresponding proportion was only 79·4 %, a figure that has been rising steadily ever since. Of the posting-stations fixed by contract, 1 179, or 85·7 % of them, received a *grant* (see above). On the whole, these figures too, are on the increase. The total amount of these grants during the period 1881—85 came to about 450 000 kronor; between 1886—90, to about 410 000 kronor; 1891—95, to about 370 000 kronor; between 1896—1900, to about 360 000 kronor and, during the period 1901—05, to about 400 000 kronor annually. — The *maximum posting-charges* are: in the Län of Göteborg och Bohus, 2·30 kronor per 10 kilometers; in the Läns of Södermanland and Kalmar, 2·20 kronor; in four Läns, 2·00 kronor; in two Läns, 1·90 kronor, in two Läns, 1·80 kronor, and in the other Läns, either 1·70 or 1·50 kronor. In the case of non-contracted postal-stations, the posting-charges were, as a rule, 1·12 kronor per 10 kilometers. The average charge for all the posting-stations in the kingdom was 1·75 kronor per 10 kilometers. — Of the 1 512 posting-stations, 885 were *country inns*. — Of all the posting-stations existing in 1905, there were 92 in the towns and 1 460 in the country districts; of the last-mentioned stations, 861 were situated on high-roads and 599 on village-roads.

4. POST SERVICE.

In Sweden, as in other cultured states, the origin of the postal service is to be found in the desire of the Government to have its important business and commands sent throughout the country by means of specially appointed letter-carriers. During the reigns of the first Vasa kings, various edicts were issued dealing with such matters. For example, a proclamation of the year 1556 ordains that free posting shall be granted to all those persons who were occupied on the business of King and country, and in 1563 an order was issued that, for the conveyance of the King's letter-carriers, there should be employed so-called "utgärd-", or military-service horses, i. e., such horses as, in times of war, were to be provided as an equivalent for a fully equipped soldier. These and similar regulations were intended for the more or less occasional conveyance of the Government post, and the letter-carriers in question might not, as a rule, be employed by private individuals. In 1620 was established on behalf of the King's governors "a certain ordinary post" for the conveyance of letters between the governors' residences and the Court. For this purpose were to be employed suitable young farmhands who were to enjoy a fixed wage, clothes, and free victuals, the latter to be provided by the King's subjects. In order to establish identity, each such carrier was provided with a kind of service-badge, the so-called post-arms, an arrangement which had, however, been in use as early as the 16th century. From 1620, the year mentioned above, we find the first mention of a post which could be employed by the general public on payment of a special fee. This post, which was intended for the conveyance of letters to and from abroad, ran from Stockholm—Markaryd (on the borders of Halland, which then belonged

to Denmark) — Hälsingör to Hamburg and was conveyed by a mounted messenger. But it can by no means be said that there hade been created an official Swedish postal service with the establishment of this post. Such a service was not established until Axel Oxenstierna, the Swedish Chancellor some few years later, who was greatly interested in the matter, took the business in hand and, after various difficulties had been overcome, succeeded in getting the Regency acting for Queen Christina to issue on February 20, 1636, an edict respecting "Post-Bådhen" (Post-service), whereby certain farms adjacent to the public highways, in consideration of being relieved from a number of public burdens, and, at a later date, also of receiving a certain fee from the postal revenues, were assigned the task of attending to the conveyance of the public post.

At a distance of every two or three Swedish miles there was thus appointed a "post-farmer" who was obliged for this service to have two post-boys, and who, either personally or by means of these latter servants, had to convey the post to the next post-farmer. During the first few years of this public postal-service, foot-messengers exclusively were employed. As early as 1645, however, mounted messengers are mentioned, the mail-cart service coming into use later on. The post was conveyed once a week between Stockholm and the southern, western, and northern parts of the country. In 1645 a postal service was established along the Gulf of Bothnia, too, and via Torneå to Finland. By degrees, sea-post connections with Gottland, the Baltic provinces, and abroad were established, by means of placing post-yachts on various lines. From 1662, we find a number of the more important mails of the country increased to bi-weekly ones. It was not till 1810 that the mail-service between Stockholm and Gothenburg was extended to four trips per week, and fifty years later the point was finally reached — partly by the employment of railway facilities — of being able to arrange a daily despatch of mails between the capital and the second city of the Kingdom. The number of post-offices amounted during the first few years to no more than 29, but by 1668 had increased to 78. — At first the postage was always the same for all distances — 2 öre silver (corresponding to about 16·6 öre of the present Swedish currency) — but it was soon graduated.

Even if the Swedish postal service, in conformity with its origin, was from the very first considered as a branch of the public service, it was not before the year 1677 that this view was fully established, the State from that time taking over in perpetuity the direction of the service and receiving all the revenues from the business. Before this date, the service had been in part leased or hired out to private individuals, but it seems, however, as if it had the whole time been under the superintendence of the Chancery, which issued the necessary directions to the head of the service, who, in official documents, is sometimes called Post Master, sometimes General State Post Master or Post Director. From 1697, the immediate management of the service was placed in the hands of the office of a Chief Post-Director, although the Chancery did not relinquish its supreme control.

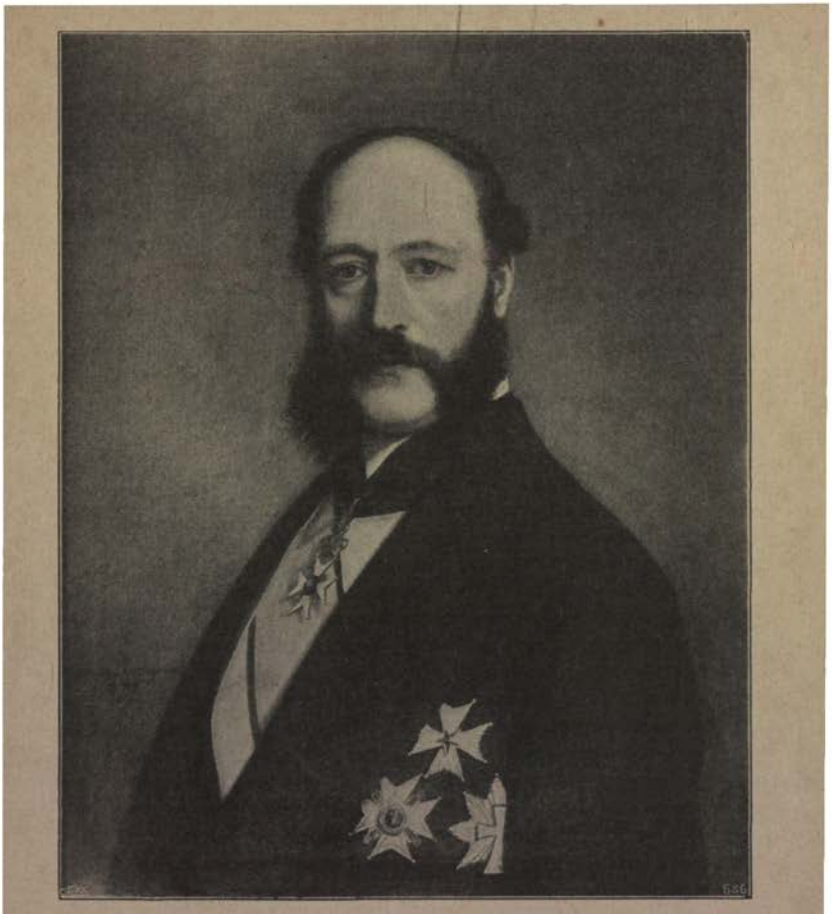
Remarkably enough, the postal institution was greatly favoured and protected during the reign of Charles XII. In 1704 were issued, from the military camp at Yaroslav, instructions to the Post Office service, which were only superseded 159 years later by the Instructions for the present Post Office Board. The "Instructions for Postmasters", issued in 1707, which were in many respects of merit, have also, in certain of their chief features, remained in force until our own times. During the last years of the reign of Charles XII, a royal ordi-

nance was issued, by which the postal service was united with the service for conveying passengers, the inns thus becoming postal-stages. Six different kinds of mail-services were established, viz., a permanent post, parcel post, driver post, running post, mounted post, and extra post. The great plan for the development of the postal service intended by the royal ordinance mentioned — which was, in many respects, in advance of its time — was never carried out, for, after the King's death, it was determined that matters should remain as they were before. Then followed a fairly long period of stagnation in the development of the Swedish Post Office.

When the Chancery came to an end in 1801 the chief Post Director obtained a more independent position with regard to the management of the service. In 1809, the superintendence was placed in the hands of the Chancery Board, established in the same year. When this Board was dissolved in 1833, the office was placed in the charge of the Finance- and Trade Office of the Government Chancery. In connection with the departmental reform of 1840, the service was placed under the Finance Department, and in 1900 it was transferred to the Home Department. In 1849, the titles of "Generalpoststyrelsen" and "Generalpostdirektören" had been introduced as the designations of the Board of the service and the head of the service. As regards the inner development of the postal service during the 19th century, mention must first be made of the introduction, in 1820, of a special postage-rate for newspapers[1] which, however, in 1824 was replaced by a fixed duty, according to the size of the paper: to control the payment of this duty, a special revenue stamp was introduced, with which every copy of a newspaper had to be marked. In 1822, there has to be noted the building of the mail-steamer, the "Constitution" — the first mail-steamer ever heard of — which ran between Ystad and Stralsund. In 1830, a regulation was issued that either contract-post or inn-post should be employed, instead of the farmer-post, for the conveyance of the mails on several new postal lines established at that time. In the same year, the rates of inland postage were thoroughly revised, the basis for the new rate being, not as before, the number of post-offices a letter had to pass, but the distance between the place of posting and the destination; by this means, a complete zone-tariff was instituted, with eleven different rates of postage. In 1849, regulations were issued for the conveyance by post also of articles with declared value. July 1, 1855, is a red-letter day in the annals of the Swedish Post Office, for on that day was introduced the uniform inland postage for letters of a certain weight, without respect to distance. Simultaneously with this, there was also introduced the use of postage-stamps and of fixed letter-boxes. At the same time, the Riksdag gave permission to apply the possible future surplus from the income of the Post Office to the extension and improvement of the service. After 1868, however, the surplus earned by the Post Office was made over to the Exchequer, to be disposed of by the Public Treasury. At the beginning of 1861 were established in the country districts the so-called *postal stations*, i. e., post-offices with limited powers and subordinate to a *head post-office* (postkontor). As early as 1859, the new means of communications, the railways, were first employed by the post-office, a postal service being arranged on the lines Arboga—Örebro and Töreboda—Gothenburg. It was not before 1863, however, that a more complete railway postal-service began; post offices were then opened at every railway station, while head postal-car offices were established on the western and southern main

[1] Until 1685, the Post Office had not only to convey, but also to compile the "Ordinary Postal News". After that date, exemption from postage was granted to the official papers, and, a little later on, to some few other privileged papers, too. It was not till 1820 that the Post Office, to any great degree, took over the distribution of newspapers, at special postage-rates.

railway lines. In 1866, money orders, and the system of forwarding articles "Cash on Delivery" (to be collected on delivery) came into use, while inland book-post came into existence in 1864, after book-post with abroad had long been in operation.



A. W. Roos.

The period (1867—89), during which the Swedish Post was under the direction of *A. W. Roos*, was one of great importance. Among notable improvements made under his administration, the following may be mentioned: In 1869, the postage for letters to Norway and Denmark was reduced to the same amount as for inland correspondence; in 1870, all the post-farms still in existence were freed from the obligation of conveying the general mails; in 1872, for the stamp-duty for newspapers was substituted a post-charge based on the subscription rates; in the same year, stamped envelopes and post-cards were introduced, and the insurance system was reorganized; in 1872 and 1881, general regulations were issued regarding the conditions on which the Post Office undertook to convey letters, etc.; in 1873, the franking privilege which had been granted to certain authorities and officials was withdrawn; in the last-named year, too, "letter-carrying for the Crown", an obligation imposed upon certain farms to transport

official letters, came to an end, a great number of new postal lines and post-offices being gradually established to replace this method of letter-carrying; in 1877 steps began to be taken to facilitate, by means of rural postmen, the transmission and delivery of letters in country districts; and in 1882, the delivery fee to postmen was abolished. It was during this period, too, (in 1875) that there was formed the Universal Postal Union, which has been of such exceeding great importance for the development of the international postal service, and by means of which the obstacles in the way this means of communication were gradually removed.

Of the development of the Swedish post-office during the two decades that closed the 19th and began the 20th centuries, it may be said that, on the whole, it kept pace with the rapid progress made by Sweden in the fields of commerce and industry. By taking part in the periodical congresses of the Universal Postal Union, and by its continuous co-operation with the permanent office of this Union, at Berne, the Central Postal Administration has stood in unbroken connection with the work of reform in the postal service which is now in progress over the entire world, and has, by this means, gained impulses to improvements to which the consent of the Government has been obtained, as far as regards the Swedish postal system. A brief mention will be made of the most important of these improvements. By means of successive reductions (1896 and 1905) in the postage for *parcels* sent by inland post, an essential increase of this branch of business has been made possible, and by this means the postal service has, to a certain degree, supplemented the work of the railways, especially in those parts of the country at a some great distance from railway communication. The *money-order-* and the C. O. D. businesses, both of which are in process of vigorous development, have been facilitated and extended by measures taken at different periods, the poundage-rates for smaller amounts, up to 5 kronor, having been adjusted, and the maximum amounts of postal orders and C. O. D. maximums having been increased, in addition to which, the powers of the post-offices and of the letter-carriers in rural districts to deal with such business have been considerably increased. From and including the month of October, 1909, the *weight of letters with the minimum postal charge* was increased from 15 grammes to 20 — a long-wished, for, and by no means unimportant, reform. From the year 1909, inclusive, there has been employed, in conformity with the custom abroad, *a card of identity*, to be employed to show the identity of the persons who wish to have handed over to them letters or parcels containing valuables, and postal money orders. From and including the November of the year mentioned, the public are able to have their receipted bills, bills of lading, current bills of promise, drafts, etc. cashed within the Kingdom through the post-office, against payment of a small fee. A long time before this date a similar money-collecting business with abroad had been in existence. Mention should also be made of the reorganization of the *newspaper-delivery business of the Post Office*, which took place in 1904 and has been employed since the beginning of 1905. The conditions for subscription to the newspaper through the post-office were then altered in such a way that the postal fees were divided into a requisition-fee and a delivery-fee, the latter based partly on the periodicity of any particular journal, and partly on the calculated total weight of the year's issues. The spread of the newspapers and journals for which the subscription was paid by the customer direct to the publishers, was facilitated by the Post-Office allowing them to be sent in the so-called publisher's wrappers at a very low postal fee. In connection with these reforms, it was determined that a running *newspaper-register* should be kept by the Post Office Board, in which there are entered printed periodicals both of older and of newer date, which have to be removed from the list in the

event of their ceasing to appear; there are also entered in the list the changes that have occurred as regards the publisher and place of publication, the number of the editions, etc. This register, which at present fills six folio-volumes, embraces 1 800 various printed publications and, even now, forms a basis for the history of the Swedish periodical press during the last few decades. Finally, may be mentioned the numerous *regulations* and *instructions* issued by the Post Office Board during the period in question, in which are summarized and supplemented older and newer regulations concerning the various branches of the postal service, for the purpose of bringing about stability and uniformity in the service. This work of codification gave rise 1912 in the "Postal regulation for head post-offices and post coupés" which embraces instructions for the treatment of the letters etc., transmitted, the newspaper department, the monetary accounts, the stock taking, and statistics.

Central Post Office, Stockholm.

The Swedish Post Office of our days is considered, on the whole, to have reached a very high standpoint, both in technical and administrative respects. Its development during the last few decades is shown statistically by Tables 132—134.

The length of *postal lines*, with regular highroad or railway service, was estimated, during the final years of last century at 39 636 km, viz., the highroad lines at 29 059 km, and the railway lines at 10 577 km. To this may further be added the steamer lines, whose length it is more difficult to calculate, but which was estimated, in 1899, at 18 552 km. With

TABLE 132. *Postal Service. Revenue and Expenditure.*

Annually	Thousands of kilometers covered by the mails				Revenue and expenditure kronor		
	On high-roads	By railway	By water	Total	Revenue	Expenditure	Surplus
1871—75 . .	6 286	3 973	.	.	3 222 687	3 256 257	(—) 33 570
1876—80 . .	6 858	7 710	4 319	**18 887**	4 725 803	4 737 061	(—) 11 258
1881—85 . .	6 131	10 221	5 364	**21 716**	5 825 174	5 167 060	658 114
1886—90 . .	6 764	13 206	6 444	**26 414**	6 656 773	6 427 723	229 050
1891—95 . .	7 184	16 045	7 243	**30 472**	8 013 648	7 457 183	556 465
1896—00 . .	7 831	19 543	6 859	**34 233**	10 411 164	9 470 849	940 315
1901—05 . .	9 847	24 136	6 561	**40 544**	15 336 962	13 855 343	1 481 619
1906—10 . .	11 928	27 688	6 930	**46 546**	19 965 403	18 301 555	1 663 848
1912	13 117	28 765	6 877	**48 759**	24 664 894	[1] 20 917 042	3 747 852
1913	13 269	29 190	7 000	**49 459**	25 707 141	[1] 21 474 095	4 233 046

[1] This does not include the costs of capital-increase.

this addition, the total length of postal lines amounted, in the year named, to 58 188 km, a figure which, by the way, very nearly coincides with the total length of all the roads of the kingdom. Since the above date, the calculated length of the postal lines has probably been doubled. In 1913 it amounted to 108 810 km of which 46 155 km are on country-roads, 14 316 km on the railways, and 48 339 km on the waterways. It must be noticed, however, that the apparent considerable increase by the last-named figures depends, almost exclusively, on the foreign lines with their very limited postal-traffic (see below). — The number of kilometers covered by the mails is shown by Table 132. As is shown there, nowadays not less than 59 % of the total number of postal carriage kilometers falls to the railways; 27 % to the country-road postal service; and 14 % to the water postal transport.

The *fixed post offices*, which, as late as 1815, numbered only 109, and in 1861, 248, increased exceedingly in number during the years 1874 and 1875 (cf. the historical review above), as in these two years they rose from 576 to 1 844. Apart from a temporary fall at the close of the "seventies", the result of a considerable number of post offices being then closed in consequence of their functions being performed by postal distribution by means of the rural postal distribution established in 1877, the number of the fixed post offices has been growing steadily in number. At the close of 1913, there were in the country 3 381 fixed post-offices, of which 245 were *head post-offices* and 3 136 *postal stations*. In 1877 there were, besides, in activity on the railway lines 329 travelling post-offices (post coupés), of which 47 (corresponding to the old "postal-coupé offices") were managed by *postal clerks* and not less than 282 (corresponding to the old "postillion coupés") by *subordinate officials*. In 1899, the number of ambulatory post offices of the former kind amounted to 107, and of the latter kind 121. The modified proportion has its explanation in the endeavour to diminish more and more the number of over-qualified officials

employed in the work of the post office. — On the steamer postal lines the public were served, during the sailing season of 1913, by 155 *steamboat post-offices,* intended, as a rule, only for the transmission of ordinary letters, post-cards and book-post packets, besides which, on the steam ferry-boat that run between Trälleborg and Sassnitz, there were opened special *sea post-offices.*

Of the 3 381 *fixed post-offices* existing in 1913, there were 702 in the five northern läns, 321 in the läns of Kopparberg and Värmland, 554 in the remaining districts of Svealand, 1 400 in Götaland, Skåne excluded, this last-named province having 404. Thus, per thousand square km, there existed in these five divisions of the country, 2·7, 6·5, 15·4, 17·2, and 35·8 fixed postal establishments respectively. These relative figures are, of course, highest for the Län of Malmöhus (48), and lowest for those of Norrbotten and Västerbotten (1·7). The average for the whole Kingdom was 7·6.

The considerable increase of late years in the number of fixed post-offices within the Kingdom has, naturally, brought about successive reductions of the size of the district which on an average is served by each such post-office and also of the number of inhabitants per fixed post-office. For example, while, for the quinquennial period 1866—70, it was calculated that the average district of each post-office, measured in square kilometers, was 961·34 and, in number of persons, 9 140; these figures in 1913 have fallen to 129·83 and 1 668. These figures clearly illustrate to some extent the increased demands made by the public on the Post Office. At the close of 1913, of the 2 376 country communes of Sweden, 1 797, or 75·6 %, had one or more fixed post-offices within their limits.

The development of *postal traffic,* with regard to the total number of letters and parcels, etc., dealt with, is shown by Table 133. For the quinquennial periods 1876—1910, the average number of *postal communications* per head of the average population amounted on an ave-

TABLE 133. *Number of Letters, etc. sent by the Post.* In millions.

Annually	Sent by letter-post					Parcels[4]	Money-orders	Newspapers and magazines (number copies)	Total number of letters, etc., sent
	Uninsured, liable to postal charges			Uninsured post-free[2]	Insured letters[3]				
	Letters[1]	Post-cards[1]	Book-post[1]						
1876—80 . .	31·00	0·71	2·40	0·37	0·51	0·34	0·18	22·83	**58·34**
1881—85 . .	41·28	2·98	4·44	0.61	0·73	0·39	0·41	31·03	**81·87**
1886—90 . .	51·79	5·11	5·41	1·11	1·04	0·51	0·62	48·09	**113·68**
1891—95 . .	60·80	6·60	8·53	2·06	1·42	0·60	1·19	70·05	**151·25**
1896—00 . .	77·07	9·77	13·17	3·85	1·70	0·98	2·35	126·02	**234·91**
1901—05 . .	101·21	41.07	20·78	5·67	2·12	1·65	3·91	170·60	**347·01**
1906—10 . .	127·71	40·78	37·03	6·41	3·43	3·80	6·64	174·35	**400·15**
1912	153·16	41·21	56·29	5·40	3·92	5·89	10·02	203·89	**479·78**
1913	155·52	41·11	58·38	5·43	4·01	6·26	10·84	208·46	**490·01**

Rem. As regards the uninsured letter-post communications and numbered copies of newspapers and magazines, the numbers given are the result of a *calculation,* made in accordance with a certain method, while, on the other hand, insured letters, parcels, and money orders are given in their actual numbers.

[1] Inclusive of registered communications with C. O. D. charges. — [2] Chiefly official postal communications. — [3] Incl. C. O. D. — [4] Inclusive of uninsured and insured parcels C. O. D.

rage to 9, 16, 22, 29, 43, 62, and 68 annually. In 1913 the figure had increased to 82. For the period 1876—80, the average number of letters, etc., transmitted by post in the whole of Sweden amounted to only 9 per head of the population. Thirty years later this figure had risen to 68, and now, as we said above, to 82. These figures can be considered as specially calculated to illustrate the immense development of the postal service in Sweden during the last few decades. Compared with the rest of Europe, postal communication in Sweden, in proportion to the population — especially if respect be paid to the original and chief object of the postal service, viz., letters — are above the average, and are really surpassed only by those of the largest industrial and commercial nations, for it is an object of general observation that it is a greatly developed commercial life that is the principal factor in the great increase of postal communications. — In the city of Stockholm, the number of letters, etc., delivered by the post amounted in 1913 to about 353 per head of the population, against an average of 50 for the period 1876—80. With regard to these figures, it must be remembered that, among the number of postal communications, there are reckoned also the newspapers subscribed for through the post, which, in the towns, occupy the first place among the various classes of communications. In Stockholm, for example, the figures for 1913 were calculated to be, per inhabitant, 207 newspapers to 140 letters, 4 parcels, and 2 postal money orders.

An extraordinary increase is shown, especially for C. O. D. communications (to be collected on delivery). While, during the period 1876—80, these communications amounted to only 0·04 millions per annum, they amounted in 1913 to 4·4 millions. During the intervening period, consequently, the number had become more than 100 times greater. Post-cards and money orders have increased more than 50-fold since 1876. The number of post-cards had risen from 0·7 million per year during the period 1876—80, to over 41 millions during 1913, and the number of the money orders had, during the same time, increased from 0·2 millions to nearly 11 millions. The increase in the number of parcels conveyed by post is also notable.

As regards the postal service with foreign countries — of the total number of communications dealt with by the Post Office, these for or from abroad amount to about one-tenth — the postal money-order business, especially, shows figures which are somewhat interesting in one or two respects. Most of the money orders go to Denmark; these, in 1913 amounted to 226 476, to a total value of 4 954 459 kronor. This corresponds, as regards number, to 47·8 % and, as regards value, to 30·6 % of all the postal money orders from Sweden to abroad. It is estimated that, of all the money orders sent to Denmark, about one-half are sent to lottery-agents. Of the postal remittances *to* Sweden, the greater part come from the U. S. A. In 1913, for example, there came from that country 202 686 postal money orders, to a total value of 14 002 677 kronor, this being, with regard to numbers and value, 48·3 and 54·7 % respectively of the whole number of the postal money remittances to Sweden. During the whole of the period that such remittances have been exchanged between Sweden and the U. S. A., i. e., 1885—1913, the amount sent to Sweden amounts to a *net* total of 120·79 million kronor, which, of course, is a very considerable sum. But it must not be forgotten that it probably does not

TABLE 134. *Letters, etc., with Stated Value; Postal Money—Orders and Newspaper-subscriptions.* Total amounts.

Annually	Stated value of insured letters, etc., sent	Amount of postal-money order values paid in (incl. of C. O. D. business)	Newspaper-subscription rates paid [1]	Total
	kronor	kronor	kronor	kronor
1871—75	414 927 636	2 584 026	871 991	**418 383 653**
1876—80	600 574 206	5 322 597	1 062 853	**606 959 656**
1881—85	684 790 151	11 697 945	1 172 104	**697 660 200**
1886—90	807 663 169	16 581 687	1 414 820	**825 659 676**
1891—95	927 994 432	27 336 840	1 738 851	**957 070 123**
1896—00	1 130 488 963	51 681 501	2 303 439	**1 184 473 903**
1901—05	1 176 094 620	107 709 583	2 999 403	**1 286 803 556**
1906—10	1 414 839 543	195 861 258	3 482 625	**1 614 183 426**
1912	1 670 980 303	346 342 865	3 923 931	**2 021 247 099**
1913	1 687 400 707	386 543 130	4 010 258	**2 077 954 095**

[1] For newspapers and magazines (payments received by the Post Office for publishers account).

equal even the amount paid for tickets by the emigrants that have left the country for the West; that it certainly does not equal the amount of ready money taken direct out of the country by the emigrants in question, not counting the sums that the young men and women, that have thus left the country, have cost Sweden for their bringing-up and education.

In Table 134 is given a survey of the stated values of the insured letters, etc., the amount of the money orders paid in (inclusive of C. O. D. business), as well as of the paid newspaper-subscription, at the post-offices of the Kingdom during the period 1871—1913. Here the increase is greatest in respect to the amount of the postal money-orders, which during the period 1871—75, amounted on an average to 2·6 million kronor per annum, but which, in 1913, came to more than 386·5 million kronor. Each of the other amounts has been about quadrupled during the years covered by the Table. The Table shows that the entire amount for which the Swedish Post Office was responsible in these respects, during 1913, came to the very respectable sum of nearly 2 078 million kronor.

The *income* and *expenditure* of the Post Office during the period that has elapsed from 1871 inclusive, is shown by Table 132. As may be seen, the income shows a surplus, which, during the last few years, has been a very considerable one. It must be remarked, however, that, for the period up to and including 1910, there are included with the expenditure, all the costs of the capital-increase. In most other countries, too, the Post Office business usually yields a surplus, which, in the case of Great Britain and Germany, is a very large one. Even the Postal Department of the U. S. A., which has hitherto laboured under a chronic deficit, has lately begun to yield a surplus.

The value of the *property* of the Post Office at the close of 1913 was estimated at 7 157 150 kronor, this sum being inclusive of the value of

the Central Post Office Building, Vasagatan, Stockholm, which was completed in 1903.

The single *steamer* at present owned by the Post Office, the "Öland", is valued at 125 000 kronor.

As regards the administration, it may be mentioned that a revision, to a certain degree, of the central and local administration of the Post Office, has been carried out from 1910, in connection with the adoption of a revised scale of salaries of the officials of the Department. As early as 1893, five *Postal Inspectors* were appointed, as intermediate authorities between the *Royal Post Office Board* and the post masters. From the year 1910, these district chiefs, whose number was then increased to six, and who were given the title of *Postal Directors,* have had their positions more firmly established, while their powers have been not a little increased. The Kingdom, consequently, is at present divided into six postal districts, entitled, the south, west, east, Stockholm, central, and north district. For the time being, however, Malmö town and the post offices and postal lines under the jurisdiction of the Malmö post office have been taken from the south district and formed into a separate section. The postal director is the representative of his district in relation to the public, and has to attend to the rigths and interests of the Post Office in that district.

The members of the *Royal Post Office Board* are the Postmaster General, as the head of the Post Office, and four Bureau Chiefs. In 1913, the permanent staff under the Board amounted to 101 persons, 43 of whom were women-clerks. In receipt of fixed salaries there are also: 1 assistant for the postal steamer, 6 men clerks and, lastly, 21 women clerks for the sorting of the money orders. In the various divisions of the Board, there were, at the date mentioned, altogether 19 permanent and 3 extra porters, besides 1 engine-man and 2 firemen.

In the service of the *district- and local administration* there were, in 1913, the following officials belonging to the higher grades: 6 postal directors, 250 postmasters (6 of these posts were not yet filled, however), 6 chief controllers, 7 first controllers, and 52 controllers, 142 men- and 27 women chief-clerks, 830 men- and 260 women-clerks, in addition to which 1 postal director at Malmö and 1 controller were placed on the provisional budget. Besides this, there were, at the close of 1913, 453 assistant clerks, 197 of whom were women, and 100 so-called temporary assistants, 88 of whom were women. The number of permanent post-office porters and mail-drivers amounted to 2 300, the extra mail-drivers 680 and the temporary assistants of corresponding grades 91.

Among the post-office staff in a wider meaning, must also be reckoned managers of postal stations to a total of 3 136, of whom 450 were women; 155 managers of the steamboat post-offices; 2 097 rural postmen; 35 so-called box postmen (whose duty it is to manage the local carriage of letters under certain simpler forms in a number of villa-towns and suburban communities); 829 postmen on highway-lines; 1 427 sellers of stamps, 320 of whom were women, and, finally, 11 persons forming the crew of the postal steamer, "Öland". The

staff above mentioned is, as a rule, appointed under agreement, either by the Post Office Board or, to a great extent, by the various postal directors. Altogether the total number of officials belonging to the district- and local-administrations, apart from the postmen on highway-lines and the sellers of stamps, amounted at the close of 1913 to 10 634 of whom 9 605 were men and 1 028 were women.

In order to obtain an appointment as an assistant clerk, it is necessary to be between the ages of 18 and 24, both inclusive, and to have a *course of training as a postal pupil.* Admission to such a course is granted only to those who have passed their matriculation or "realskole" examination, or who possess a full final certificate from the State Normal School for Girls in Stockholm, or from any other 8-class girls secondary school whose final certificate is considered as showing qualifications equal to those required for the "realskole"-examination. The course of the postal pupils lasts 21 months and embraces trial practical post-office work as postal-pupil probationer during the period August 16—January 15, a theoretical course at the educational institute of the post-office in Stockholm during the period February 1—May 15, and a practical pupils'-course during the period June 1—May 15. The final examination is held during the latter half of the May of the final year of training.

5. TELEGRAPH SERVICE.

The first optical or **signal telegraph** (semaphore) in Sweden was erected in 1794. In the autumn of that year, a **signal** telegraph, constructed by *A. N. Edelcrantz,* was tried between Stockholm and the Royal Palace of Drottningholm, 10 kilometers distant.

The telegraph erected — almost simultaneously with that of Chappe in France, but on an independent system — proved so practical that, during the following years, new telegraph-lines were established between Stockholm and various important points at the sea-entrance to the capital, as well as at several places on the west and south coasts of the country. The constructions mentioned, which to a great extent were brought about by the necessity, during the war of 1808 and 1809, for a quick and safe signal-service, fell into decay, however, at the end of the war. It was only in 1836 that the Government determined on their re-establishment: a telegraph-corps was established, under the direction of the chief of the Topographical Corps, and received its regulations in 1838.

The subsequent development of the signal telegraph was, however, of very short duration, in consequence of the discovery of the incomparably greater capability of electricity to convey communications quickly and surely over great distances. After the introduction of the electric telegraph, the signal telegraph stations were, by degrees, done away with, and the last was removed in 1881.

The **first electric wire telegraph** in Sweden was set up in 1853, between Stockholm and Uppsala, under the superintendence of Major-General *Carl Akrell,* who afterwards became the first Director-General of the Telegraph Service. During the two following years, new lines were put up from Uppsala, via Västerås, Örebro, and Vänersborg,

to Gothenburg; from Stockholm along the coast to Malmö, and from Malmö to Gothenburg. As early as 1854, Sweden was placed in telegraphic communication with the continent by a submarine cable in the Sound.

The Swedish telegraphs received a more stable organization in 1856, by the establishment of the *Royal Telegraph Service*, to which were entrusted not only the electric, but also the signal telegraphs. More or less thorough changes have been made from time to time in this organization, partly in consequence of an increase in the use of telegraphic communication (this was especially the case after the reduction in the rates for telegrams in 1889 and 1907), and partly — and chiefly — in consequence of the immense development of the telephone system during the last decade of the 19th century and the first ten years of the present one.

The State telegraph-net at the close of 1913 embraced 30 470 km over-head lines and cables, carrying both telegraph- and telephone-wires. The length of the telegraph-wires was 34 030 km, in addition to which, 4 647 km of telephone-wires were employed simultaneously for telephoning and telegraphing. Along the lines of railways there were 11 084 km of over-head lines and 29 487 km of telegraph-wires owned by the *railways* and intended principally for railway-service messages, but which, as a rule, are mostly employed in forwarding telegraphic despatches for the public. The *total length*, consequently, of the telegraph-wires of Sweden, amounted to 63 517 km.

The independent *stations* of the Telegraph Service at the close of 1913 numbered 162, of which 4 had day- and night-service; 116 had all day-service and 42 had partial day-service. If to these we add 15 branch telegraph-stations in Stockholm and Gothenburg, and 1 029 other sub-offices opened by the Telegraph Service, so-called telegraph-rooms and telegram receiving-rooms (situated for the most part on private premises) which receive telegrams from the public and send them by means of telephone to the nearest State telegraph-office — as far as regards the telegraph-rooms, these stations also send the telegrams received to their addressees — and 514 offices at the State Railway stations and 1 266 at the stations of the private railways, the total number of telegraph-offices in the kingdom amounts to 2 986.

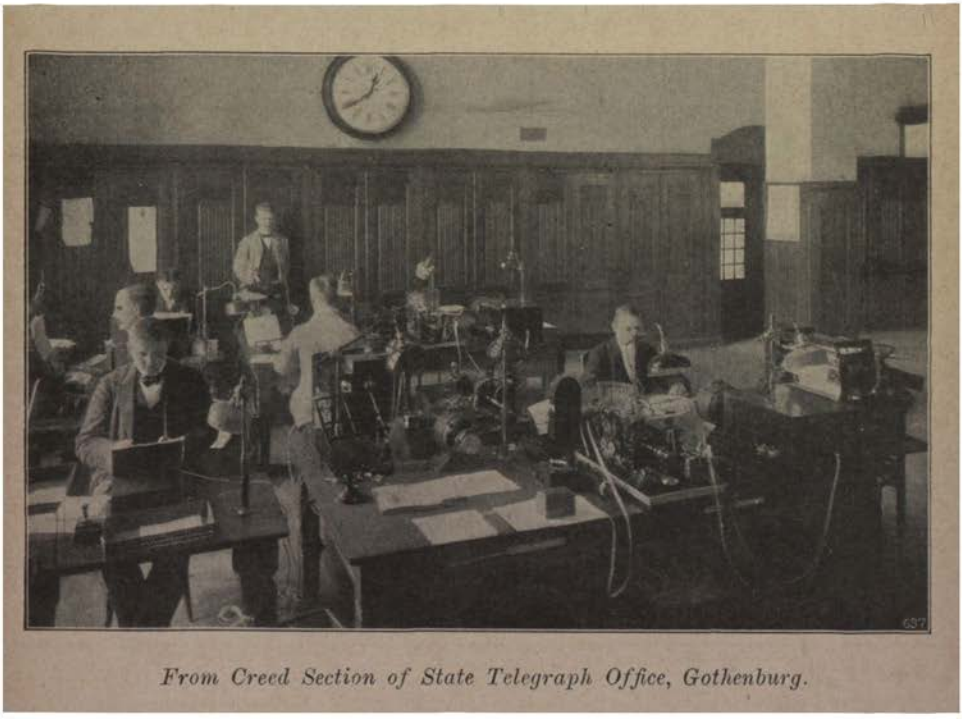
TABLE 135. *Development of the State Telegraph Network.*[1]

Year	Telegraph-lines	No. of paid telegrams				Income from fees	Capital common to Telegraph- and Telephone Services	Return in % of average of capital disposable during year
	km	Inland	Foreign	Transit	Total	kr.		
1860	6 778	105 963	38 059	15 146	**159 168**	475 513	2 120 856	3·51
1870	14 515	365 975	177 275	47 050	**590 300**	749 748	4 393 294	2·47
1880	20 336	550 841	345 318	90 261	**986 420**	1 204 878	5 701 910	0·87
1890	22 884	961 476	603 517	190 352	**1 755 345**	1 412 018	5 574 807	4·78
1900	27 992	1 252 848	889 216	364 255	**2 506 319**	1 800 913	25 696 750	9·55
1910	32 220	1 658 957	1 368 401	872 841	**3 900 199**	2 265 193	72 513 083	7·30
1912	32 467	1 944 866	1 584 013	1 106 913	**4 635 792**	2 606 472	82 500 709	8·45
1913	34 030	2 053 647	1 590 594	1 155 038	**4 799 279**	2 678 673	88 218 180	7·69

[1] Railway telegraph lines not included.

Every State telephone, too, is, as a matter of fact, a telegraph-office, as the subscribers have the right, on certain conditions, to telephone in messages for further despatch to a telegraph-office, and also to receive per telephone from these last-named places telegrams that may have arrived there for the said subscribers.

As regards the *apparatus system* employed, the Telegraph Service has consistently adopted all the improvements and developments made, and has employed the inventions best suited to the conditions existing in Sweden. Many such inventions or improvements have been made by the Service's own officials and have been turned to practical use. The system which is most employed for the telegraph-service in the country is based on that invented by the American, Morse, arranged on the open-circuit plan, the messages being received partly by tape and partly by ear. In connection with the method of receiving by ear (by "sounders"), the system of writing out the message by typewriter is coming extensively into use.



From Creed Section of State Telegraph Office, Gothenburg.

On wires with a heavy traffic there is employed duplex- (the simultaneous despatch of two telegrams, one in each direction) or quadruplex (the simultaneous sending of four messages, two in each direction) telegraphing, or else the automatic Wheatstone-system. Murray's printing-telegraph system has been tried, and since 1913, the Creed printing telegraph has been in use on all of the most important lines.

For the railway telegraph wires Morse-apparatus are chiefly employed, operated partly on the open, partly on the closed, circuit plan, a small number of so-called needle telegraph apparatus are still in use, however.

Within Stockholm, since 1906, there has existed a local telegraph network using instruments from Siemens & Halske, Berlin, not only at the stations of the Telegraph Service, but also at those of a number of firms possessing exten-

sive correspondence, which make use of this means for receiving and despatching telegrams from and to the Central telegraph station.

During 1913, the Telegraph Service opened a local "news ticker" service in Stockholm, of which the apparatus was also supplied by Siemens & Halske, the central station being on the premises of the Svenska Telegram byrån (Swedish Press Agency). The subscribers to this service receive, day and night, news and notices which are type-printed on a paper-tape by the apparatus.

The inland *telegraph rates*, which, at first, were in proportion to the length of the wire or the distance between the stations, were made uniform, from the year 1865, for the whole kingdom, and, until 1889, the rate was 1 krona for telegrams, of 20 words with an additional 25 öre for every additional 5 words. From the beginning of the year last mentioned, the rate was fixed at 5 öre per word, with a minimum rate of 50 öre per telegram, while, from the beginning of 1907, the minimum rate was lowered to 25 öre per telegram. For the sake of comparison, it may be mentioned that the existing rate fee for a 5-word telegram is, in the following countries: in Sweden, 25 öre; Denmark, 50 öre; Great Britain, 6d; France 50 centimes; Norway 50 öre; Switzerland, 45 centimes; Germany, 50 pfennig; Austria 60 heller. Special, lower fees have been fixed in Sweden for local telegrams, press-messages, and for telegrams to and from the Telegraph Service's stations on Gottland, during the period when the regular postal communications with this island are interrupted by storms, etc.

The rates for telegrams to abroad, which depend on the number of national telegraph administrations the telegram has to pass and on the fees which have to be paid to these departments, have, during the course of time, been repeatedly lowered, especially to countries with which Sweden has commercial intercourse of any importance. From the middle of 1912, there has existed a deferred telegram service with half rates for extra-European messages in plain language; agreements have been made with a large number of countries for lowering the charges for press-messages to half rates. A night letter-telegram service, with $^2/_5$ of full rate charges, has existed since the beginning of 1914, between Sweden and Denmark.

As regards the *transmission of telegrams*, it may be mentioned that, during 1913, the *number* of inland telegrams amounted to 2 053 647; of foreign, terminal telegrams from Sweden to abroad, to 733 426, and to Sweden from abroad, to 857 168; transit telegrams to 1 155 038, or, together 4 799 279 paid telegrams. The number of paid telegrams which passed over the railway telegraph lines only amounted in 1913 to 94 685. *The total number of paid telegrams* from or to Swedish stations, or via Sweden, thus amounted to 4 893 964. Of the total number of Sweden's telegrams to or from abroad, those to and from Germany amounted to 28·8 %; Great Britain 24·5 %; Denmark 11·6 %; Norway 10·3 %; France 5·1 %; Russia, not including Finland, 4·5 %; Finland 4·2 %; the Netherlands 3·1 %; Belgium 1·5 %; other European countries 3·9 % and extra-European countries 2·5 %. The number of free telegrams (official and meteorological messages) sent over the State telegraph wires was 294 274.

The total of the telegram fees received by Sweden for the telegrams forwarded by the Telegraph Service amounted, in 1913, to 2 678 673 kronor; the total income of the telegraph net (including the fees for the registration of telegraphic addresses to an amount of 49 590 kronor; rent for telegraph wires, amounting to 30 448 kronor, etc.), came to 2 771 675 kronor. As the working expenses amounted to 2 545 631 kronor, there was, for the year mentioned, a surplus on the income of the Telegraph Service of 226 045 kronor, or, 4·87 % of the average capital employed during the year for the telegraph net, which amounted to 4 642 582 kronor.

Wireless telegraphy is in process of rapid development at the present time in Sweden. In 1910, was opened the first public *coast station,* erected by the naval authorities at Karlskrona; in 1911, was opened the station at Gothenburg, erected in common by the Naval and Telegraph Service, which was afterwards taken over by the Telegraph Service; in 1912, was opened the wireless telegraph-station at Trälleborg for the State Railways, which, however, is only used for the transmission and reception of messages to and from Sassnitz and the steamtrain-ferries on the route between Trälleborg and Sassnitz, and, finally, in 1914, a station at Vaxholm was opened for public service. Thus, exclusive of a number of stations operated by the Navy or erected for instructional purposes, there were, at the close of 1914, a total of four coast stations open for public service. The number of *shipstations,* which, at the close of 1912, was 42 had, by the close of 1914, increased to 63, of which number 26 were on mercantile vessels and 37 on warships. Of the former, there are stations for the use of the public on the Thule S/S Co's steamers "Saga" and "Thule", running between Gothenburg and London, and on the two steam-ferries running between Trälleborg and Sassnitz — although the two last-mentioned stations exchange telegrams only with each other, and with the coast-stations at the two towns in question. The other stations on mercantile vessels are intended principally for the convenience of the shipping companies and vessels alone; the Naval ship-stations for naval correspondence alone.

The coast-stations are arranged on the Telefunken system, with musical spark (tönende Funken), a system on the elaboration of which a Swedish engineer, R. Rendahl, has expended much meritorious labour. The normal ranges by day of each of these stations is 350 nautical miles, except that of Trälleborg, which is about 250 nautical miles. The wireless system of the ship stations on trade vessels is the Telefunken, except on 10 of them, where the Marconi system is in use.

The fee for a radio-telegram is made up of the ordinary telegram charge for despatch by wire, a coast charge, which falls to the share of the coast station, and a ship charge, which belongs to the ship station. For the Swedish coast stations, the coast charge is 10 öre per word, with a minimum total charge of 1 kr. per telegram; the ship charge varies on the different boats, and runs from 10 öre per word and a minimum total charge of 1 kr., to 30 öre per word and a minimum charge of 3 kr. per message.

The traffic- and income figures have, of course, not yet become of any great importance. During 1913, the coast stations together received or despatched 3 193 paid messages, comprising 40 263 words, the coast charges for which amounted to 4 381·60 kr. During the first seven months of 1914, this kind of traffic largely increased, but, as, for well-known reasons, the number of sea-going vessels within the range of the Swedish coast stations during the latter part of the year was greatly diminished, the figures for 1914 are scarcely higher than those for 1913. The ship stations on board Swedish vessels during 1913 dispatched altogether 2 872 paid messages, comprising 32 736 words, and received 4 791 messages comprising 8 651 words; the ship charges for these messages amounted to 4 404·60 kr.

The Telegraph Service, under whose administration lies not only the care of the ordinary wire-telegraph system, and that of the plants for wireless telegraphy which is not under the management of the Army or Naval Departments or the State Railways, but also, and above all, of the State Telephone Service, is not an independent Government Department, but was, until April 1, 1900, under the Finance Department, and since the date mentioned, has formed a branch of the Civil (Home) Department. The *Royal Telegraph Board* consists of a chief, with the title of Director-General, with the sole right of deciding matters, and three bureau chiefs (one for the administrative, one for the line-, and one for the traffic sections). When certain matters are under discussion, the Board is strenghened by two special commissioners. Altogether, the staff of the Board at the close of 1914 numbers 60 established and 21 unestablished officials, inclusive, since 1909, of an officer who has been appointed the military adviser of the Board.

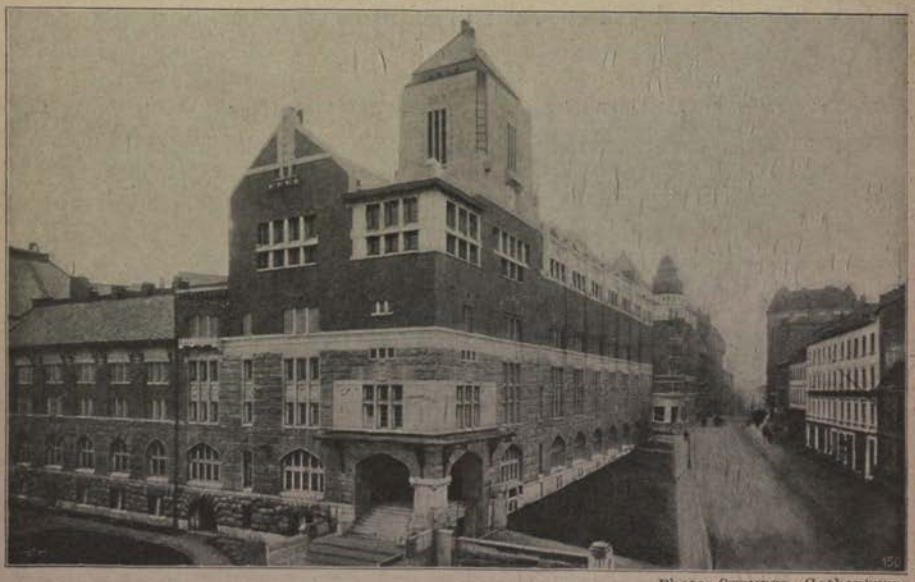


Photo. STENDER, Gothenburg.

State Telegraph and Telephone Buildings, Gothenburg.

With regard to traffic and finances, and with respect to the telegraph- and telephone services, the country is divided into four *traffic-districts,* each superintended by an inspector; for the erection of new lines and premises, etc., and the maintenance of the old ones, the country is divided into seven *line districts,* each with a line director as its head.

The *traffic staff,* which includes the officials of the four traffic district bureaus and the whole staff of officials at telegraph and telephone stations, according to the budget for 1915, amounts to 4 inspectors (superintendents), 2 telephone directors, 4 telegraph directors, 70 men managers, 15 controllers (men super-

visors), 128 assistants (male telegraphists), 100 women managers, 355 women telegraphists, 83 women supervisors at the telephone exchanges, 890 long-distanec telephonists and 92 other regular officials, together with about 2 196 extra officials, 1 512 of whom were local telephonists. Among the traffic staff may also be included about 2 300 persons who hold the position of managers or assistants at sub-exchanges.

The *line staff,* consists of the 7 line directors already mentioned, 21 line-engineers, 414 other established and 26 extra officials; the number of workmen employed in the line districts during 1914 amounted, on an average, to 1 424.

The **telegraph workshops** which were established in Stockholm in 1891 for the manufacture and repair of telegraph- and telephone-accessories, and which were removed, in 1913, to Nynäshamn, are under a director,who is assisted by 3 engineers and 6 other established officials. The number of workmen employed at the works during 1914 was, on an average, 477, and the value of the material turned out during the same year was 1 937 887·18 kronor.

6. TELEPHONES.

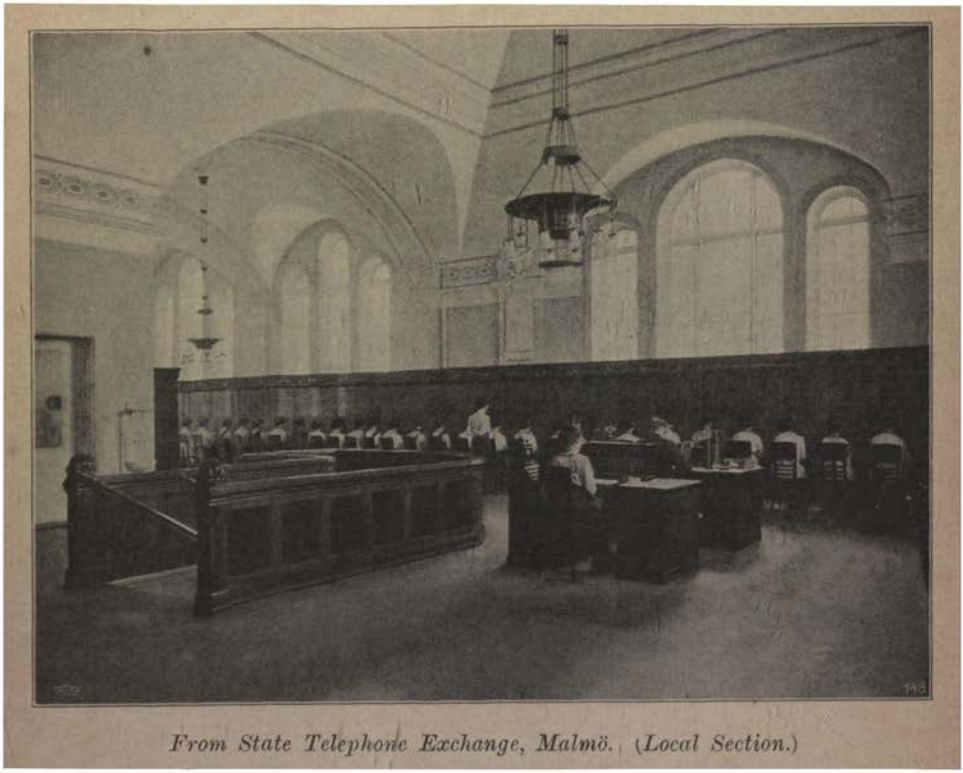
If, in respect to the telegraph-system just described, Sweden is on a level, with other countries, both as regard technics and traffic-arrangements, it has led the way, as far as the telephone-service is concerned, during a long part, at least, of the period of the development of the telephone. Not only has Sweden adopted all technical improvements, and introduced original devices invented in the country, both as regards the manufacture of the apparatus, the fitting-up of the offices, and the construction of lines and networks, but in quantitative respects, too, such a pitch of development has been reached that, in proportion to its population, Sweden has had more telephones in use than any other country in the world, and, even at present, is surpassed in this respect only by one country in Europe — Denmark — and by two or three extra-European countries.

The telephone-service in Sweden began in the form of private telephone companies, of which, however, the greater number were afterwards persuaded to sell their lines to the State, after it had itself begun to establish a telephone service. The largest of the private companies, the Stockholm Telephone Co., which consists of an amalgamation of two original companies — the Stockholm Bell Telephone Co., Ltd and the Stockholm General Telephone Co., Ltd — still survives, however, as a not unimportant rival of the State Telephones, as the proposal that the State should buy the Company in question, a proposal repeatedly made, has come to nothing, in consequence of the unwillingness of the Riksdag to pay the amount of compensation demanded.

The first telephone network in Sweden was constructed in 1880, by the *Stockholm Bell Telephone Co., Ltd.* Almost at the same time, there were set up telephone nets in Gothenburg (1881), Malmö, and Sundsvall, and some other, smaller, towns (in 1881, or the years immediately following). In order to facilitate communications between the Government departments, another network was opened in Stockholm in 1881, by the *State Telegraph Service,* which, in 1882,

set up telephones in Uddevalla and Härnösand, besides establishing several lines of communication between telegraph and private offices.

Simultaneously with these first installations and during the period immediately following, *private telephone associations* were formed, it may be said, at every place of importance in the country. These associations, which contributed greatly to the development of the Swedish telephone system, were formed, as a rule, by a larger or smaller number of persons in a town or a district, which felt a need of telephonic communication. The capital necessary for the common exchange was contributed, and apparatus, etc., were bought in common, but each member paid for what he used, and, as a rule, each one erected and paid for his own line. The management was carried on, often free of expense by a committee chosen from among the members of the association, and, as each individual kept his line in repair, the annual fees, needed only for the maintenance of the exchange and the telephone service, were remarkably low.



From State Telephone Exchange, Malmö. (Local Section.)

In a number of larger towns, however, limited companies, operating for profit, undertook the setting up, etc., of telephones. That the fees in these cases were considerably higher was a matter of course, so much the more as greater demands were made upon these erections in regard to technical quality.

The connection of the networks at various places came about when the technical improvements by degrees rendered conversations over greater distances possible. In most cases, the necessary capital was obtained by subscription, and no fee was payable for conversation even between different districts.

About 1890, the *private* telephone plants were calculated to embrace a length of 40 000 km of line, and about 16 000 telephones in use. At

TABLE 136. *Number of Telephones in use in various Countries, 1913.*

	No. of telephones in use	Per 1 000 inhab.		No. of telephones in use	Per 1 000 inhab.
Denmark	118 398	42	Austria	161 230	5
Sweden	217 554	39	Hungary	75 738	4
Norway	75 000	31	Rumania	21 000	3
Switzerland	90 573	23	Italy	89 166	2
Germany	1 302 672	19	Spain	34 000	2
Great Britain	738 738	16	Russia (Finland etc.)	282 481	2
The Netherlands	77 195	13	Portugal	8 040	1
Finland	35 200	11	Servia	3 606	1
Belgium	58 640	8	Greece	3 097	1
France	293 195	7	Bulgaria	3 200	0·7

that period, the *State* began to devote itself to the telephone business with greater energy. At the close of 1900, the State telephone system had about 52 000 telephones in use; the Stockholm telephone companies, 27 000 instruments; and other private companies, possibly about 5 000 — the last named figure being, however, uncertain. The total number of telephones in the whole of Sweden thus amounted, at the time mentioned, to about 84 000, or about 16 telephones per thousand inhabitants; the average figure for Europe at the same time was probably not more than 2 telephones per thousand inhabitants. The total length of the telephone lines of the whole of Sweden may be calculated to have then been about 160 000 kilometers. At the close of 1913, the above figures had increased as follows: the State telephone net possessed 159 252 telephones; the Stockholm Telephone Co., 73 577; and other private companies, 2 544, or a total of 235 373 telephones in use, which is equal to 41·7 instruments per 1 000 inhabitants; the total length of the Swedish telephone lines was 500 397 km. For the sake of comparison with the rest of Europe, some figures (see Table 136) may be given for the commencement of the year 1913.

In the whole of Europe there were, at the same time, about 3 695 400 telephones, corresponding to 8 telephones per 1 000 inhabitants; in the whole world the total number of telephones was about 13 570 900, and as many per 1 000 inhabitants as in Europe.

A comparison between the chief capitals of Europe, as regards the number of telephones in use, is given in Table 137.

TABLE 137. *Number of Telephones in use in various Cities, 1913.*

	No. of telephones	Per 1 000 inhab.		No. of telephones	Per 1 000 inhab.
Stockholm	79 964	228	Vienna	56 747	27
Copenhagen	50 802	84	Buda-Pest	24 567	28
Christiania	20 729	86	Brussels	21 470	26
Berlin	144 543	62	Petrograd	47 649	28
London	244 320	34	Rome	10 400	20
Paris	95 033	32	Madrid	4 031	7

Among cities with more than 100 000 inhabitants, there is not one in Europe that approaches Stockholm; in the U. S. A., on the other hand, there are three towns that have relatively more telephones, of which cities Los Angeles, in California, is the first, having 264 telephones per 1 000 inhabitants. The figures given above are for January 1, 1913; at the close of 1914, Stockholm had 241 telephones per 1 000 inhabitants.

State Telephones.

As we have mentioned above, the State had set up telephone networks, although in a small scale, as early as in the first half of the eighties. In 1883 and 1884, the State bought two of the largest systems in the extreme south of Sweden, and these became the starting-points for fairly large telephone networks in that part of the country. In order to support the fishing industry, which at this time began to flourish in Western Sweden, the State (partly with aid from the local authorities), erected extensive telephone communications in that part of the country, too.

It was, however, not till the technical problem of rendering possible conversations over *long distances* was solved that the activity of the State became more vigorous. In 1889, the first more important line of communication, that between Stockholm and Gothenburg, was opened, over a distance of 500 km, and, as several similar long lines were constructed by the State, the local networks, too, came into its possession, partly by purchase, partly by new erections, not only along the chief highways, but also in more remote parts of the country. These networks, by means of lines of lesser length, were brought into connection with the trunk lines between the large centres, and by this means the *State telephone net* gradually came into existence.

Tab. 138 gives a general survey of the development of the State telephone network from 1890 to 1913, both years inclusive.

As regards the charges paid by private subscribers for telephone connection, these, in most places in Sweden, amount to an annual fee of 50 kronor, in

TABLE 138. *Growth of the State Telephone Network.*

Year	No. of exchanges	No. of telephones	Double telephone lines Km	Single telephone lines Km	Total telephone lines (circuit, not wire length) Km	Telephone calls against subscription[1]	Telephone calls against special fee	Receipts Kr.	Average subscriptions per apparatus
1890	126	4 947	4 656	8 123	**12 779**	8 156 856	128 737	440 258	87·99
1895	559	22 735	45 079	10 542	**55 621**	47 000 000	1 555 638	1 936 152	66·38
1900	1 077	51 998	105 466	6 520	**111 986**	131 261 200	3 065 700[1]	3 988 553	54·96
1905	1 380	81 994	161 928	4 468	**166 396**	224 177 000	6 842 100[1]	7 030 807	48·61
1910	1 932	128 410	260 546	2 905	**263 451**	318 008 200	14 228 900[1]	12 016 695	48·56
1911	1 983	137 799	282 780	2 428	**285 208**	287 954 500	16 200 287	13 261 785	48·52
1912	2 064	148 372	294 653	2 105	**296 758**	277 047 500	18 381 940	14 574 354	48·44
1913	2 159	159 252	325 439	2 092	**327 531**	302 182 400	19 826 353	15 586 330	48·55

[1] Approximately.

addition to which there is an entrance fee also of 50 kronor, besides a fee for the use of any specially-desired type of instrument. In some places, however, the fee is somewhat higher, but there it is usually reduced after 5 years' subscription. In other places, again, there is in force a system of lower annual and entrance fees, but with a restriction in the right to free calls. In towns and in places possessing a comparatively large number of subscribers, these fees cover the cost of erection and maintenance of the subscriber's line within a certain district, which is usually the district within the town-limits, or else a circular area of two, one, or half a kilometer's radius around the telephone exchange; the fee also includes the cost of the exchange service for the subscriber's wire. In smaller places, however, the subscribers themselves usually see to the erection and maintenance of the lines and also pay either themselves entirely, or with the help of a contribution from the Telegraph Service, the cost of the exchange-service for their lines. No annual fee is paid for the right to calls on the connecting lines between the offices — *long distance wires* — but this right may be made use of by every subscriber against payment of rates calculated on the actual length of the lines, i. e., for a distance:

up to 100 km	15 Öre	from 800 km to 1 000 km	1·00 Kr.
from 100 » to 250 km	30 »	» 1 000 » » 1 200 »	1·25 »
» 250 » » 600 »	50 »	» 1 200 » » 1 400 »	1·50 »
» 600 » » 800 »	75 »	» 1 400 » » 1 600 »	1·75 »
		» 1 600 » and above	2·00 »

These tolls or fees are for a three minutes' call. For each new, successive period of three minutes, or part thereof, the same fee is paid as for the first period. *Express calls* pay double rates, and, on lines where, for ordinary calls, no fee is paid, 15 öre per period of three minutes. *Series calls*, i. e., calls which recur at regular intervals, are charged for as express calls, with an exception for *press series calls*, for which the ordinary first fee is paid. *Night calls* can be had from 9 p. m. to 7 a. m., against reduced rates, which are $^1/_2$—$^3/_5$ of the ordinary fees; at certain offices, however, these fees are increased by extra charges — so-called night service charges — which have to be paid both for local and long-distance calls. A charge of 25 öre is made for sending a messenger to call a non-subscriber to a telephone. There is an extra charge of, usually, 10 öre for calls made from a public call-office.

At present, there exists long-distance telephone communication between places of any importance in the Kingdom, and a call can be made between any of the offices which are connected with the network, i. e., calls can be made over a distance of more than 2 000 kilometers.

In technical respects, the State telephone network can show quite a wonderful course of development, both as regards the growth of the network, the exchange plant, and the construction of the apparatus. The Swedish Telegraph Service made all its connections — those of the subscribers', inclusive — metallic, as early as from the year 1889, i. e., at an earlier date than in the case of any other administration. Since the beginning of the nineties, the wires of the subscribers in every place where there is a large number of subscribers have been placed underground, in cables lying in cement tubes, a method of construction first proposed by C. A. Hultman, telephone director in Stockholm, and which has since been employed, on an ever increasing scale, for almost all the telephone networks in the world. From the very first, on all the over-head lines of any length, the wires have been put up according to a system framed on scientific principles, designed to prevent various kinds of disturbances. Since 1908, and in accordance with the calculations made by H. Pleijel, the consultative Professor attached to the Telegraph Service, a large number of the long-distance and other connective lines have been loaded, i. e., have, by

means of a method first employed by Professor Pupin, been artificially given electric characteristics which make possible, on the one hand, a more distinct transmission of speech over long lines, and, on the other, allow of the employment of a cheaper material (wire of smaller dimensions) in the construction of such lines. The total length of the Telegraph Service's loaded bare wire- and cable circuits was, at the close of 1913, some 29 967·6 km. On the whole, it may be said that Sweden possesses one of the best constructed long-distance networks in the world.

A practical application of the progress made in telephone technics is the so-called phantom lines, or the arrangement that three conversations are transmitted simultaneously on two lines. As a result of the calculations and inventions of Professor Pleijel, the devices employed for this purpose in the State telephone network have reached an exceedingly high degree of perfection, and, at the close of 1913, there were in use 9 846 km of such superposed connections.

It is two officials of the Telegraph Service, C. E. Egnér, C. E., and the principal of the Service's training school, G. Holmström, C. E., to whom should be ascribed the honour of having invented the first practical strong-current telephone for use on long lines. By its means, a conversation can, without difficulty, be carried on over unloaded lines of ordinary dimensions between Stockholm and Paris. The patent for Sweden has been bought by the Telegraph Service, and a fairly large number of instruments is already in use. Switch-boards and telephones were, at the beginning of the State Telephone Service's existence, for a long sequence of years, supplied by L. M. Ericsson's world-renowned factory, in Stockholm. Afterwards, however, the workshops of the Telegraph Service gradually began to provide, on an ever increasing scale, the telephones that were needed, and the establishment in question has also designed and executed most of the new plants and carried out the necessary work for the maintenance and improvement of the offices. Since, as mentioned above, the Swedish Telegraph Service was among the first administrations that realized the necessity of, and carried out, the change from single lines to double ones, the exchange apparatus necessary for the new line-system had to be invented and constructed within the country. The switch-board system employed at the central and sub-exchange offices are, therefore, as a rule of Swedish manufacture. The distribution system applied in Stockholm and Gothenburg, which has, too, been adopted at Hamburg for an 80 000 lines' plant was the invention of A. Avén, telephone controller. The central-battery system, introduced at a number of other offices, such as Malmö, Norrköping, Hälsingborg, Jönköping, Gävle, etc., is a modification of the world-renouned system invented and manufactured by the firm of L. M. Ericsson. Essential improvements in the old magneto system, which is still made use of at smaller and medium-sized stations, have been elaborated chiefly by A. H. Olsson, line-engineer, and have been utilized at the stations at Härnösand, Karlstad, Kristianstad, Västerås, Östersund, etc. Automatic exchange-stations, although on a small scale, on a system invented by G. A. Betulander, C. E., engaged at the workshops of the Telegraph Service, have been in use since 1903, and very promising experiments for larger stations have been made by other officials of the Service. A central exchange for 2 000 subscribers, with a semi-automatic system on an American model, has just been opened at Landskrona.

Chiefly in consequence of the well devised and well executed exchange systems, but also as a result of systematic selection, exercise and superintendence of the staff, the *rapidity of service* in the State telephone — offices has reached such a degree of excellence that what, in many other countries, is merely a heart-felt wish, is in Sweden already an accomplished fact. Even some ten years ago, the average time elapsing between the subscriber's making a call and his obtaining a response from the attendant, at the largest exchanges in Sweden, had been

reduced to, or below, 5 seconds, and at the newer stations, such as those at Malmö and Hälsingborg, statistics show an average wait of 2·5 seconds, and even less, for such reply.

Finally, some figures may be given respecting the *economic results* of the administration of the Swedish telephone service. The means which are required for the continued development of the State telephone system, were, before the year 1911, placed at the disposal of the Board of the Telegraph Service chiefly in the form of loans, for which the Telegraph has paid interest, and which had gradually to be amortised by the Service, and this, as a rule, in a very chort period (12 to 20 years). From and including the year 1911, however, public grants have been made for the purpose in question, these amounting, for each of the years 1912, 1913, and 1914 to 4 million kr. (the grants given in 1913 and 1914 were, to a certain, small amount, also intended for telegraph purposes); for 1915, the grant amounts to 4 650 000 kr., inclusive of 50 000 kr. for radio-telegraphic (wireless) purposes. The capital, consisting of such supplies together with the Telegraph Service's own profits, which had been sunk in the State telephone network had, at the close of 1913, amounted to 65 994 450 kr., 42 971 306 kr. of which was sunk in the local networks, and 23 023 144 kr. in the long distance network. If respect be paid not only to the plant investment, but also to the whole of the capital disposable for the telephone system, this latter amount during 1913 came to 67 335 639 kr., of which 43 844 601 kr. were for the local net, and 23 491 038 kr. for the long-distance network. Now, as the surplus obtained from the business, i. e., the difference between the receipts and the expenditure, amounted, for the local network to 2 576 782 kr. and for the long-distance net to 2 576 782 kr., it will be seen that the local telephone network of the Telegraph Service yielded, during the year, a return of 6 %, and the long distance net one of 14 %, on the capital available for the respective branches of the business. The surplus yielded by the entire telephone system amounted to 8·8 % of the capital (in 1912 to 9·6 %), a result which, if we take into consideration the low terms of subscription and charges for conversations, and the very extensive right to free calls possessed by subscribers at many places, must be considered as very satisfactory indeed.

In the figures given above for capital investment in the State telegraph and telephone systems no capital invested in *land and buildings* is included. For the purpose of buying sites and constructing buildings, means have been supplied in various ways, for the last few years in the form of grants, amounting for 1913 to 400 000, and for 1914 to 500 000 kr. At the end of 1913, the prime cost value of assets of this kind, belonging to the Telegraph Service, amounted to 9 696 940 kr. The net income of this branch of the business, however, only amounted to 155 896 kr., or 1·6 % of the average capital, the reason for these low figures being that a very large part of the investment during 1913 was

still represented by sites, recently bought and not yet built on, or buildings, not yet ready or not wholly taken into use.

Private Telephone Companies.

Mention has already been made (cf. above) of the origin of these companies in Sweden and how the greater number of them afterwards passed into the possession of the State. It now remains to give a short account of the largest and most important of the private companies still existing, i. e., those in **Stockholm.**

The private telephone lines of Stockholm and the surrounding district are at present in the hands of the Stockholm Telephone Company, Ltd which, on January 1, 1908, purchased the Swedish telephone lines of the two then existing and co-operating telephone companies — the Stockholm General Telephone Company, Ltd and the Stockholm Bell Telephone Company, Ltd.

The Bell Company was established in 1880, chiefly with American capital, and at first, employed only American material. Its charges, however, were so high (160 kronor for "the city within the bridges"; 240—280 kronor in the rest of Stockholm) that the general public could not make any great use of this new means of communication. Representations were therefore made urging a lowering of the tariff and, when no attention was paid to this demand, there was formed in 1883, on the initiative of *H. T. Cedergren, C. E.*, — whose services in connection with the development of the telephone-system of Sweden are deserving of the very greatest praise — the Stockholm General Telephone Company whose object was stated to be "to establish and carry on telephone-communication within Stockholm and with other districts, on terms as low as the security of the financial position of the company would permit". The tariff of the new company for subscribers having sole right to a wire was fixed at 100 kronor for the whole of Stockholm, but other, lower rates of subscription were soon introduced. Both the companies mentioned continued to exist and extend their operations until the year 1885, when Stockholm possessed, not only relatively but also absolutely, the greatest number of telephone-subscribers of any city in the world. After the date mentioned, the number of subscribers to the Bell Company diminished more and more, and, at the close of the "eighties", the majority of its shares were purchased by the General Company, and, in 1892, the wires of the Bell Company were reserved for the home-telephone service alone.

The General Telephone Company grew rapidly, not only within the capital but also in the country districts in the immediate neighbourhood of Stockholm. In addition to this, a telephone service was established at Söderhamn and Jönköping, and long-distance lines connected the capital with Norrköping. The Company also entertained the idea of erecting long-distance lines to Gothenburg in order to place the lines of private telephone companies there in connection with Stockholm, but the application for the concession, which was made in 1888, was refused by the Government. The steadily increasing difficulties that were raised against the work of the Company in Stockholm soon made it desirable for a definite agreement to be made regarding the territory within which the Company should enjoy an indisputed right to carry on its business. Consequently, after negotiations with the Board of the State Telegraphs, an agreement was drawn up which, later on, was approved by

the Government, and, in accordance with which, the Company was granted the right to retain all its existing telephone wires within a district extending to 70 km in every direction from Stortorget (the centre of Stockholm), and to erect new lines within this territory. The condition on which this agreement was drawn up was that the Company should, at the same time, sell to the Telegraph Service all its lines outside the above-mentioned district.

By an agreement made with the Board of the State Telegraphs, there was established in 1891 co-operation between the lines of the State Telephones and those of the private companies, whereby all subscribers in the capital enjoyed the use of extensive local lines and of extensive telephone-connections with provincial districts. This co-operation came to an end in 1903.

In 1902 and 1906, proposals were made by the State Telegraph and Telephone Departments to purchase the telephone lines of the General Company but, on each occasion, the Bill was thrown out by the Riksdag. Neither did a proposal made in 1904, to divide the field of operations between the State Telephones and the General Company, gain the approval of the Riksdag, so that it has not been found possible to find any solution of the co-operation problem. Since the cessation of co-operation, however, the lines of the private company have increased at a constantly increasing rate.

* *

In 1899, it came to the knowledge of the General Telephone Company that the Russian State intended to issue invitations for an international competition respecting telephone-concessions in the five Russian cities of Petrograd, Moscow, Riga, and Odessa. After an investigation made by Mr Cedergren at these places had shown that there was a great field of work for the telephone-traffic in Russia, there were established two Swedish telephone companies: the Swedish-Danish-Russian Telephone Company, Ltd, and the Cedergren Telephone Company, Ltd, in both of which the General Telephone Company was the principal shareholder, and which sent in tenders for the proposed Russian plants. The result was that the Swedish-Danish-Russian Telephone Company obtained the concession in Moscow and the Cedergren Telephone Company that in Warsaw. New and first-class telephone plants have since been established in these cities and have obtained large numbers of subscribers. Before the Swedish Companies began their work in Russia, the American Bell Company had enjoyed telephone-concessions in these cities, but, after having been founded 20 years, the number of its subscribers was not more than 3 058 in Moscow, and 2 331 in Warsaw. On January 1, 1913, i. e., after 12 years of activity, the number of subscribers to the Swedish-Russian Companies' lines was 43 347 and 28 935 respectively.

In combination with L. M. Ericsson & Co., the General Telephone Company has also established a telephone service in the city of Mexico and its suburbs. On January 1, 1913, this combined company had 9 202 subscribers.

In proportion as the business of the General Telephone Company increased there arose a growing difficulty in obtaining a clear view of the working of the various divisions and, especially, in distinguishing the economic results of the Stockholm lines from the other business of the Company. On January 1, 1908, was formed the Stockholm Telephone Company, Ltd, which, as was mentioned above, took over the lines of the General Telephone Company and of the Bell Telephone Company in Stockholm and the surrounding districts. The General Telephone Company is the principal shareholder in the Stockholm Telephone Company.

During the whole of their existence the private telephone companies of Stockholm have endeavoured to extend the use of the telephone among

Apparatus Room of the principal Exchange of the Stockholm Telephone Co.

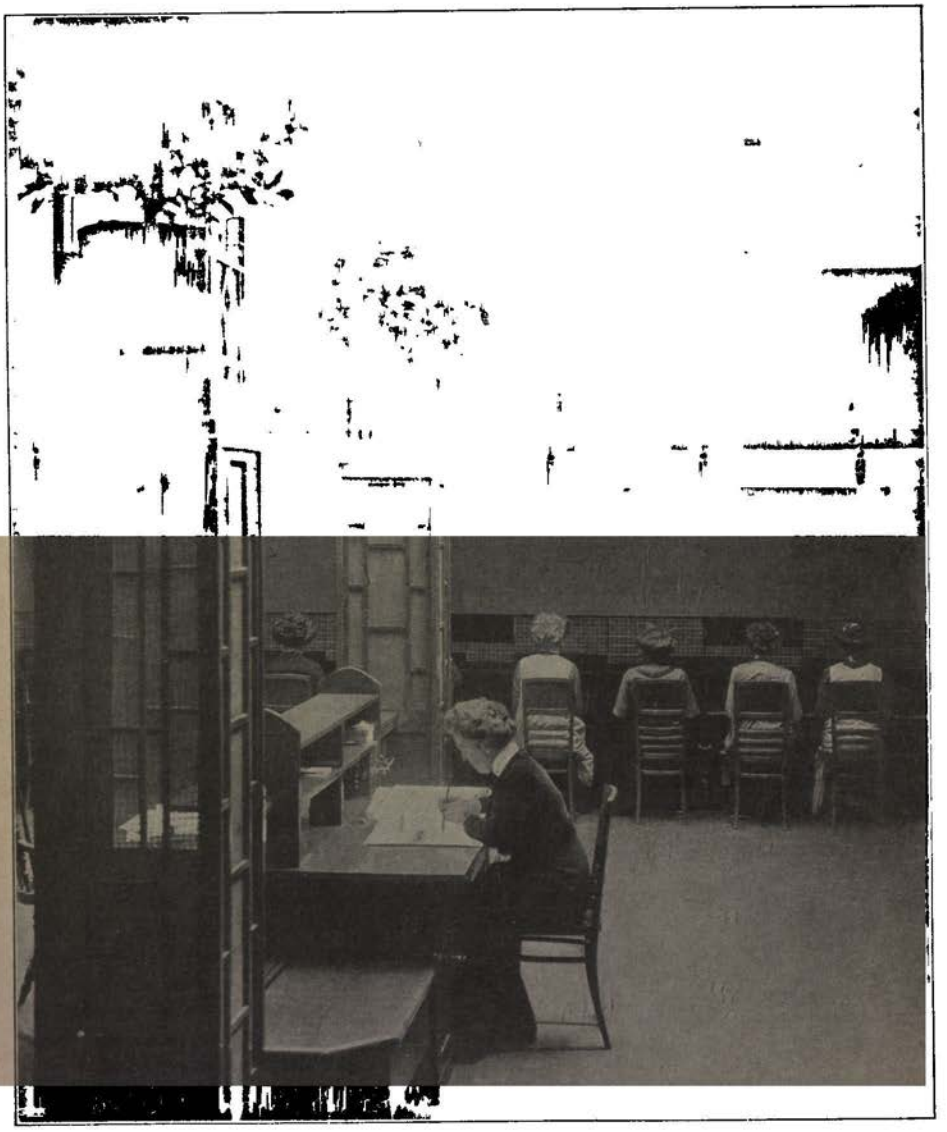
an ever-increasing number of classes of society and to render their lines and the service first-class. The first object has been achieved by the introduction of low tariffs, suited for those whose use of the telephone is limited; the second by continually improving the construction of the instruments and by adopting new inventions when these have proved suitable for the purpose. For example, the General Telephone Company began to use the multiple board as early as the spring of 1884, being probably the first company in Europe to do so; it employed metallic circuit lines in a country town as early as 1888 and, during the years 1892—93, duplicated the whole of its great Stockholm system of wires. In 1895, the Company began to lay down underground cables in the streets of the capital, and after the Stockholm Telephone Company had taken over the business, the entire system of lines in Stockholm was transformed in order to allow of the introduction of the central battery system. All the lines leading to subscribers' apparatus have thus been isolated in cables; new apparatuses have been erected and new sub-stations for the service of home-telephones arranged, in premises purchased by the Company. The last step in this work of transformation consisted of the reconstruction of the chief station in Malmskillnadsgatan, where a system for automatic distribution, constructed by the Company, is to be introduced.

The Company's system of country lines has also in part been transformed and, especially, labour has been expended on removing the large aereal lines and substituting underground cables, which are constructed according to the system of Pupin, the American (cf. State Telephones). The longest countrycables thus constructed lie between Stockholm and Mariefred and have a length of 70 km.

The tariffs of the Stockholm Telephone Company are: within Stockholm, for telephones with an unlimited number of calls, 100, 80 and 60 kronor, and for telephones with a limited number of calls, 45, 36, and 20 kronor. The last-named subscription, which was introduced after the transformation of the net to a central battery service, allows of an unlimited number of free calls to the 100 kronor apparatuses, the number of which on January 1, 1914, amounted to more than 10 000. For every call to any other apparatus than these there is a fee of 5 öre. In the provincial towns around Stockholm, the subscription tariffs are, 50, 36, and 25 kronor, while, in the rural districts, they are 65 and 44 kronor. The development of especially the cheaper telephones has been exceedingly great during the last few years. On January 1, 1914, the number of subscribers amounted to 73 577. The increase during 1913 was 5 414.

The total length of the lines of the Stockholm net of telephones was 127 306 km, and of those in the country-districts, 38 033. At the same date (the beginning of 1914), the number of stations in Stockholm was 7, and in the country 172. On January 1, 1914 there were in the service of the Company 1 654 persons, 142 of whom were officials, 940 operators, 537 foremen and workmen, 35 collectors and errand-boys.

The value of the telephone lines and other erections of the co-operating telephone companies in Sweden and Russia amounted, on January 1, 1914, to 87 million kronor, the total number of subscribers' apparatuses being 155 377.



Local Station (Östermalm) of the Stockholm Telephone Co.

Finally, on page 651, figures are given from which the reader may draw a comparison between the development of the telephone system in Sweden and some other countries. In proportion to the population, Stockholm has more telephone apparatuses than any other city, viz. 228 per 1 000 inhabitants (1913). At the end of 1914 the proportion is still more striking, viz.: 241 per 1 000 inhabitants.

XI.

BANKING, CREDIT, AND INSURANCE.

1. COINAGE.

Since 1873 Sweden has had a *gold standard*, and gold is thus the sole measure of values. The monetary unit is 10 kronor in gold, and the reckoning unit is 1 krona, which is divided into 100 öre. Out of 1 kilogram of fine gold are coined 248 10-kronor coins, and a 10-kronor piece thus contains 4·032258 grams of fine gold. The token coins are made of silver and bronze.

The *gold* coins are the 20, the 10 and the 5 kronor pieces. Gold coins are made of an alloy containing 900 ‰ of gold and 100 ‰ of copper. A 20-kronor piece should thus contain 8·064516 grams of gold, and weigh 8·9606 grams, and the other coins in the same ratio.

The token coins of *silver* are the 2 kronor piece, the 1 krona, and the 50, 25, and 10 öre pieces. The alloy of which silver coins are made varies in its percentage of silver for the different coins. In the 2 kronor piece and the 1 krona it contains 800 ‰ of silver and 200 ‰ of copper, in the 50 and 25 öre pieces it contains 600 ‰ of silver and 400 ‰ of copper and in the 10 öre piece it contains 400 ‰ of silver and 600 ‰ of copper. Out of 600 grams of fine silver are coined 100 kronor in 2 kronor, 1 krona, and 50 öre pieces, and about 103 kronor in 25 and 10 öre pieces. The various coins should thus weigh 15, 7·5, 5, 2·42 and 1·45 grams, and contain 12, 6, 3, 1·452 and 0·58 grams of fine silver, respectively.

The token coins of *bronze* are the 5, 2, and 1 öre pieces. The alloy of which bronze coins are made contains 95 % of copper, 4 % of tin, and 1 % of zinc. The coins should weigh 8, 4, and 2 grams respectively.

Coins are minted at the Royal Mint, *Kungliga Myntet*, at Stockholm. As it is, of course, impossible to give the coins *exactly* the above weights and percentages, the Coinage Act allows of certain *remedies* (*remedier*) or limits of deviation above or below the standard weights and percentages. The extent of these deviations will be seen from the appended tabular conspectus of the Swedish coinage.

Token coins are struck only for the account of the Public Treasury, the five kronor pieces for both the Public Treasury and the Bank of Sweden (*Riksbanken*),

and the 20 and 10 kronor pieces for anyone who, subject to certain conditions, takes gold to the Mint to be converted into coin.

In order to be accepted for coinage, the total bulk of gold must contain over 900 ‰ of gold, must not contain any other metal except copper, and must not be so brittle as not to allow of its being rendered malleable by melting in a crucible. If the value of the gold is up to half a million kronor, the Mint is obliged to coin it as soon as practicable. If the value is lower, the Master of the Mint may either accept it for coinage, meet it in cash after deducting the cost of coinage, or refuse to accept it. Gold to a value of less than 500 kronor is not accepted. Gold may also be taken to the Mint for the account of the Riksbank, without obligation to state the purpose.

The charge made by the Mint for coining 20 kronor pieces is 1/4 % of the total value of the gold presented, and for coining 10 kronor pieces 1/3 % of the total value of the gold presented; besides which there accrue certain fees for the re-melting and malleableizing of the gold, when this may be necessary. For the conversion of gold into 5-kronor pieces, the Riksbank pays 1/2 % of the total value of the gold.

Gold coins are legal tender to unlimited amounts. The token coins are unlimited legal tender only to the Public Treasury. Otherwise no one is obliged to accept in payment more than 20 kronor in 2 and 1 krona pieces, more than 5 kronor in smaller silver coins, and more than 1 krona in bronze token coins.

The 20 and 10 kronor pieces cease to be legal tender to the Public Treasury when they have lost by ordinary wear and tear more than 2 % of their gross weight. They cease to be legal tender to all others when they have lost more than 0·5 % of their gross weight. The 5 kronor piece ceases to be legal tender to the Public Treasury when it is so worn that it can no longer be distinguished as a Swedish coin. The 5 kronor piece ceases to be legal tender to all others, when it has lost more than 0·6 % of its gross weight. If a gold coin has been injured, it is no longer legal tender to anybody whatever.

The token coins cease to be legal tender to the Public Treasury, when they are so worn that they can no longer be distinguished as Swedish coins. They cease to be legal tender to all others when the stamp has become indistinct. Coins which have been injured are no longer legal tender; but, subject to the approval of the Master of the Mint in each separate case, they may be taken by the Mint at their face value.

At all offices of the Riksbank anyone is entitled to have any amount of token coins, provided the amount be divisible by 10, exchanged for gold coins or Riksbank notes. Moreover any one is entitled to have any amount of such worn coin as is legal tender to the Public Treasury, exchanged for an equal amount of current coin. The Riksbank, in its turn, is entitled to have that coin exchanged by the Mint for gold coin or Riksbank notes.

As regards the dissemination of token coins, anyone is entitled, on sending in equivalent value to the Mint, to have silver coin, within certain limits as to amount, forwarded post-free to any post office, or first-

TABLE 139. *The Coinage of Sweden.*

In pursuance of the Coinage Act of the 30 May 1873 with appendices.

Reckoning Unit: 1 krona = 100 öre.

Metal	Legal value of coin	Diameter mm	True weight gr	Deviation above or below true weight thousandths	Maximum weight in minting gr	Minimum weight in minting gr	Minimum weight as legal tender *B*: to Publ. Treasury gr	Minimum weight as legal tender *B*: to all others gr	True percentage thousandths	Deviation over or below true percentage thousandths	Minimum percentage in minting thousandths	Maximum percentage in coining thousandths	Fine gold weight at true weight and percentage gr	Maximum amount anyone is obliged to accept in payment kr.
Gold	20 Kronor	23	8·9606	per coin 1·5 *A*	per coin 8·97404 *A*	per coin 8·94716 *A*	8·78139	8·91580 *C*	900	1·5	898·5	901·5	8·064516	Unlimited
	10 Kronor	18	4·4803	2·0 *A*	4·48926 *A*	4·47134 *A*	4·39069	4·45790 *C*	»	»	»	»	4·032258	»
	5 Kronor	16	2·24015	3·0 *A*	2·24687 *A*	2·23343 *A*		2·22671 *C*	»	»	»	»	2·016129	»
Silver	2 Kronor	31	15 0	3·0	15 0450	14·9550			800	3·0	797	803	12·0	20 *E* altogether
	1 Krona	25	7·5	5 0	7·5375	7·4625	When it is so worn that it cannot be distinguished as a Swedish coin	*D* When the stamp has become indistinct by wear and tear.	»	»	»	»	6·0	
	50 Öre	22	5·0	pr 1 kg 6·0	pr 200 coins 1 006·0	pr 200 coins 994·0			600	»	597	603	3 0	5 *E* altogether
	25 Öre	17	2·42	10·0	pr 413 coins 1 009·4346	pr 413 coins 989·4654			»	»	»	»	1·452	
	10 Öre	15	1·45	15·0	pr 690 coins 1 015·5075	pr 690 coins 985·4925			400	»	397	403	0 58	
Bronze	5 Öre	27	8·0	—	—	—			950 Cu 40 Sn 10 Zn	—	—	—	—	1 *E* altogether
	2 Öre	21	4·0	—	—	—				—	—	—	—	
	1 Öre	16	2·0	—	—	—				—	—	—	—	

A. In minting gold coins the deviation above or below true weight for 10 kg of coin must not exceed 5 gr.

B. Gold, silver, or bronze coins which have been mutilated or damaged by clipping, piercing, soldering, or in any other way unlawfully injured, cease to be legal tender. However, such coins of silver or bronze may be taken by the Mint at their face value, when the damage has not appreciably diminished the weight of the coin, always subject to the approval of the Master of the Mint.

C. Coins which have weights lower than those here given must not be put back into circulation, once they have been received by the Public Treasury.

D. Silver token coins which have a lower weight than 14·4 gr for 2 kronor, 7·2 gr for 1 krona, 4·8 gr for 50-öre pieces, 2·32 gr pieces for 25-öre pieces, and 1·39 gr for 10-öre pieces, must not be put back into circulation, once they have been received by the Public Treasury.

E. The Public Treasury accepts in payment unlimited amounts.

class sub-office. Moreover, in all offices of the Riksbank anyone is entitled to have gold coin or Riksbank notes exchanged for small coin.

In 1873 Sweden and Denmark concluded between them a Coinage Treaty, which Norway joined two years later. In accordance with the terms of this Treaty, all three countries have the same coinage system, with essentially the same regulations.

The coinage of each country is legal tender in the two other countries. Each country is obliged to accept from the Public Treasury of the other countries such coins bearing the stamp of that country as are legal tender only to the Public Treasury. Likewise, each country shall accept from the Public Treasury of the other countries and exchange for gold coins any amount, divisible by 10 kronor, of token coins which bear the stamp of that country. — No limit is set, as regards amount, to the right to issue coins, either in the Treaty or in the Swedish Coinage Act.

The Treaty shall cease to be in force a year after due notice has been given by one of the parties, with the proviso that the regulations above referred to with regard to the obligation to exchange worn coins and token coins shall be in force two years after the Treaty has been abrogated.

The amounts in kronor of the Scandinavian coins which were issued up to 1913 inclusive, in accordance with the stipulations of the Coinage Treaty, are exhibited by the following conspectus:

Gold Coins:

	20-kronor	10-kronor	5-kronor	Total
Sweden up to $^{31}/_{12}$	71 474 500	11 762 090	2 146 505	**85 383 095**
Norway » » $^{30}/_{6}$	21 428 560	1 214 560	—	**22 643 120**
Denmark » » $^{31}/_{2}$	73 909 040	13 832 650	—	**87 741 690**
Total	**166 812 100**	**26 809 300**	**2 146 505**	**195 767 905**

Only 44 035 kronor were called in by the Mints.

Silver Coins:

	2-kronor	1-kronor	50 öre	25 öre	10 öre	Total	Called in
Sweden	7 062 964	15 882 567	3 452 713	6 650 452	4 563 223	**37 611 919**	1 466 855
Norway	3 922 834	4 676 995	3 213 133	2 004 670	3 107 188	**16 924 820**	2 465 877
Denmark	11 477 070	6 225 388	—	4 858 106	3 655 706	**26 216 270**	1 663 539
Total	**22 462 868**	**26 784 950**	**6 665 846**	**13 513 228**	**11 326 117**	**80 753 009**	**5 596 271**

Bronze Coins:

	Total	Called in
Sweden	2 842 723	53 247
Norway	1 160 350	7 172
Denmark	2 110 160	31 899
Total	**6 113 233**	**92 318**

The amount of Scandinavian *gold* coin held by the Riksbank on the 31 December 1913 was 55 957 745 kronor, and the amount of such *gold* coin held by all others banking companies together was 207 170 kronor.

Hall-marking of Gold, Silver and Pewter Wares.

Legal regulations as to the finess required in gold, silver, and pewter intended to be wrought into wares have existed from a very early date in Sweden. The oldest Goldsmiths' Decree known dates from the year 1529.

At first the hall-marking of these wares was superintended mainly by the Goldsmiths' and Pewterers' Guilds themselves. The Riksguardien, as the Government official was called who exercised a general superintendence over the making of gold and silver wares, had duties essentially of a fiscal nature, and, as a rule, only intervened when there was a suspicion of embezzlement. The Hall Marks Act of 7 Dec. 1752 placed the actual fabrication of these wares under State control. These matters were at first managed by Kontrollverket, or the Assay Office, at Stockholm, established in the following year. In 1910 they passed over to *Mynt- och justeringsverket* or the Royal Mint and Assay Office (shortly called below Royal Mint). The Act of 1752, with certain amendments and appendices was in force until 1912. In that year a new Act was passed as to the hall-marking of gold and silver wares. That Act entirely abolished the hall-marking of pewter wares.

As regards alloys, the legal minimum for gold wares is 760 ‰, and for silver wares 830 ‰. In the case of gold three different qualities are hall-marked: 23 carat gold (standard mark: 23 k) with 975 ‰ of gold; 20 carat gold (standard mark: 20 k) with 840 ‰ of gold, and 18 carat gold (standard mark: 18 k) with 760 ‰ of gold. As to silver, only one quality is hall-marked, namely 830 ‰, without a standard mark. As in the case of coinage (see above), certain remedies or deviations from the above standard qualities are allowed for, namely 5 ‰ for gold wares and 8 ‰ for silver wares. Further, soldered wares may contain only so much solder that the gold, supposing the ware to be melted, shall not fall more than 10 ‰ below the standard, and the silver not more than 16 ‰ below the standard. Gold or silver wares may not be combined with other metals which might easily be taken for gold or silver.

When gold and silver wares are submitted to be hall-marked, they must be stamped with (1) the maker's mark (2) the mark of the place of manufacture (3) the date mark (from 1759 onwards). Gold wares must also have the standard mark.

The hall-mark for gold wares is three crowns in a *heart-shaped* shield for Swedish wares, and three crowns in an *oval* shield for foreign wares. Silver wares have a similar hall-mark, followed by an S. At the capital these hall-marks are affixed, after due examination, by the Royal Mint. In the provinces hall-marks are affixed by an official, on the faith of the maker's statements as to quality. Samples are then taken of the wares, and these samples are sent in to the Royal Mint for examination. If the maker has made a false declaration as to the quality of his wares, he renders himself liable to prosecution.

The fee charged for hall-marking is 5 öre per gram of gold, and 3·33 kronor per kilogram of silver. Gold wares weighing under 1 gram, and silver wares weighing under 5 grams, are exempt both from hallmarking and the fee. The maker, however, is liable to be prosecuted, if it be detected that his wares fall below the minimum standards.

Gold and silver wares which fall below the minimum standards with remedies are not allowed to be *imported* into Sweden. Hence all gold and silver wares which come from abroad have to be sent up to the Royal Mint and Assay Office for examination. If they are up to the required standards, they are hall-marked, and the fee charged is the same as for Swedish wares. They also pay an additional fee for every test which has to be made. Wares which fall below the required standards have to be re-exported. The import of foreign gold and

silver wares seems to have been prohibited until 1826. They were first hall-marked in 1832.[1]

The Table on page 462 shows the quantities of gold, silver, and pewter wares hall-marked since the introduction of official hall-marking in 1754.

As to trade in gold and silver wares, only such wares as conform to the required standards may be offered for sale. Exemptions from this rule are conceded only in special cases.

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2. BANKING.

Historical Sketch.

The Riksbank in Ancient Times. The first bank in Sweden, **Palmstruch's Bank,** obtained its charter in 1656. It consisted of two departments, the deposit or current account bank, and the lending or loan bank. The deposit bank was prohibited from lending money deposited or crediting anyone for amounts which had not been deposited. The lending bank was for loans on corporeal securities, such as real property, certain kinds of commodities, and other objects of value; it also received deposits at interest. In 1661 the bank began to issue notes.

The Palmstruch Bank was mismanaged and before long found itself unable to meet its engagements. It proved impossible for it to stave off bankruptcy, notwithstanding that the State came to its relief, *inter alia* by declaring its notes to be legal tender and guaranteeing their being met in cash. In 1668, in place of the Palmstruch Bank, a State Bank was founded. At that time it was designated "*Rikets Ständers Bank*", that is, the "Estates of the Realm Bank", but it is now known as **Sveriges Riksbank,** the *Bank of Sweden.* It was to be governed by the Estates of the Realm solely, the Government being excluded from all participation in its management. Its business was to be the same in kind and be prosecuted on the same lines as that of the Palmstruch Bank, but subject to an express prohibition against the issue of notes. In 1701, however, the right of note-issue was accorded to the Riksbank.

At the outset the number of notes in circulation was very small but later on, when the Bank had obtained the right to issue notes for small values, it began, with the laudable intention to encourage industry, to transact its lending business in far too generous a spirit, the consequence being that the issue of notes was swelled beyond the bounds of prudence and the Bank in 1745 was obliged to suspend payment of its notes. In conjunction with the coinage reforms of 1776, whereby copper was ousted from its place of primacy and silver alone became the standard metal, the Bank once more resumed payment of its notes at about half their face value, that being the degree of depreciation they had experienced.

It was not long, however, before the Bank monetary machinery was again out of gear. When the State, owing to the war with Russia in 1788—1789, found

[1] In 1832 even gold and silver wares which fell *below* the above standards were permitted to be imported: they were stamped with a special hall-mark.

The Buildings of the Bank of Sweden, Stockholm, with the Riksdag Buildings at the background.

itself obliged to raise new loans, the Estates of the Realm undertook to be responsible for the management of the National Debt, establishing a special board of commissioners under their own supervision to administer it, viz. *Riksgäldskontoret* or the National Debt Board. In order to procure the money required by the State, this Office was authorized among other duties to issue notes and to carry on a certain kind of banking business. However its notes, the "*riksdaler riksgälds*" as they were called, soon depreciated in value, whereas the notes of the Bank, the "*riksdaler banco*", retained their value unimpaired. In 1802 it was resolved that the Bank should redeem the Riksgäldskontoret notes with its own at the then average exchange value of the former (i. e. at two-thirds of their nominal value, one Riksdaler Banco being thus equal to one and a half Riksdaler Riksgälds). Partly in consequence of this measure and partly owing to a loan to the Government during the war of 1808—1809, the financial position of the Bank became so much impaired that in 1810 it was actually compelled to stop redeeming its own notes, which in consequence fell considerably in value. After years of negotiations the authorities finally succeeded in 1830 in putting the monetary affairs of the country into order by a so-termed "realization". It was then resolved that the Bank should resume the redemption of its own notes in silver, though at only three-eighths of their nominal value, which corresponded pretty closely to the exchange value of the notes. Towards the close of the year 1834 this resolution was carried into effect. Since that time the Riksbank notes have continued to be convertible into cash (temporary interruption in 1914 on account of the war).

The *lending business* of the Bank consisted originally, as has been stated,

in loans on mortgages and "Lombard loans", i. e. loans on commodities. The former passed by a gradual transition into long period loans. Loans against merely personal security did not, properly speaking, occur until after 1802, when the National Debt Board had given up its banking business above referred to. For the last-named loan transactions a special institution in close contact with the Bank was established, viz. the *Riksdiskonten*, or State Discount Bank, which at first was a combination of the Bank and certain private shareholders; in 1816, however, the latter were excluded. Since 1830 the banking business of the Bank has gradually been transformed into closer conformity with sound banking principles. Thus, in 1846 the Bank began to discount bills, in 1864 the "Riksdiskonten" was abolished, its business being taken over by the Bank itself, and in the same year the Bank ceased making loans on mortgages for long periods, that business being transferred to the *Allmänna Hypoteksbanken*, the General Mortgage Bank.

The Interior of the Bank of Sweden, Stockholm.

The Origin of the "Enskilda" Banks. At the close of the eighteenth century and at the beginning of the nineteenth there were established in Stockholm a series of *diskontoinrättningar* or discounting establishments, one following on after the other, as they successively came to grief after enjoying but a brief spell of existence. In some of these institutions the capital was subscribed in part by private persons in part by the State, in others by the State alone. Similar establishments were also opened in some of the larger towns with private capital, but with aid from the Riksbank.

However, one of these provincial institutions was soon obliged to suspend payment, and the others were before long forced to put up their shutters, as they failed to win the confidence of the public.

On January 14 1824 a Royal Ordinance was issued authorizing the creation of "Enskilda" or discount banks. However, it was not until after the finances of the country had been reestablished on a satisfactory footing by the "realization" (see above) of 1830 that the facilities thus made available for the foundation of "Enskilda" banks were actually made use of. Under the Ordinance the sanction of the Government was required for the establishment of an "enskild" bank, and the stockholders were *jointly and severally liable* for the engagements of the Bank. Although the Ordinance did not contain any regulations with regard to powers of note issue, the banks nevertheless soon began to issue their own notes. The conditions to be complied with in such issue were afterwards specified by the Royal Ordinance of 1846. This Ordinance further restricted the business of the banks, inasmuch as it prescribed that they were only to be allowed to *carry on trade* in gold and silver. A later Ordinance (1855) widened this limitation to include domestic and foreign bills and interest-bearing securities. An attempt to supersede the note-issuing banks by other banks without powers of note issue but supported by the Riksbank — the sotermed Branch Banks — did not turn out a great success. The regulations as to the right to issue notes were subsequently amended by the Royal Ordinances of 1864 and 1874.

Pursuant to the Ordinance of 1874 at least 60 % of the subscribed capital (*grundfond* "foundation capital") of the Bank was to be invested in mortgages and easily realizable interest-bearing bonds, and these "foundation capital securities" *(grundfondshypotek)* were to be deposited in public custody *(allmänt förvar)*, whereupon the Bank was entitled to issue notes to an amount equivalent to: — (1) the foundation capital and the reserve fund, in so far as these were invested in "foundation capital securities" deposited in public custody, (2) such amount of the Bank's outstanding claims on the public as corresponded to half the foundation capital, subject to the condition that the Bank held at its head office gold currency up to 10 % of the foundation capital, (3) the Bank's other holding of gold in specie or bullion at the head office. — The downward limit of value for notes was 5 kronor (in 1879 raised to 10 kronor).

The Ordinance of 1874 remained in force until the close of the year 1903, when it was superseded by the Unlimited Liability Bank Companies Act, at the time when the "Enskilda" banks were deprived of their right to issue notes. The Act of 1903 was in its turn superseded by the Banks Act of 1911.

That the "Enskilda" banks were deprived of their right to issue notes was not due to dissatisfaction with their management. Out of the total of 30 "Enskilda" banks that have been founded, only one has ever become insolvent, and even in its case it was not necessary to make any calls on the unlimited liability stockholders. Thus the notes of the "Enskilda" banks have never been inconvertible.

The Origin of the Joint-Stock Banks. The Joint-Stock Companies Act of 1848 brought into being banks with *limited liability*, but without the right to issue notes. The first joint-stock bank was opened in 1863. It was not till 1886 that the joint-stock banks were brought under special legislation, whereby their activity was subjected to legal restrictions similar to those in force respecting the "Enskilda" banks. The Act of 1886 was superseded by the Joint-Stock Banks Act of 1903, which Act in its turn was rescinded by the Banks Act of 1911. Altogether, 98 Joint-Stock banks have been established in Sweden; 63 of these are still in existence.

The Banks Reform of 1897. The value to the Swedish industrial community of the services performed by the "Enskilda" note-issuing banks were indeed generally admitted: they were useful as credit-providing institutions, more especially as by their ramifying network of branch offices they served the needs of a great many and even quite small places, thus greatly facilitating the collection and utilizing of the savings of the public. Nevertheless, as the nineteenth century drew towards its close, it was felt that the time had come to bestow on the country the benefit of a central bank in the proper sense, enjoying a monopoly as regards the note issue. It was generally agreed that the bank which was to be invested with that monopoly must be the Riksbank; on the other hand, people were not in accord as to the organization best adapted to fit the bank for its special mission. Two Committees (1881—83 and 1889—90) brought forward proposals on the subject, but it was not till the 1897 Riksdag that the measure of reform was actually carried into effect. Pursuant to the resolutions then adopted, the Riksbank was still to have the Riksdag at its back and remain subject to its supervision, private stockholders continuing to be excluded. Laws affecting the Riksbank were to be enacted by King and Riksdag conjointly, the King being accorded besides some influence in the constitution of its governing body. The Riksbank was to exercise the *monopoly of note issue* from and after 1904 (though, as a matter of fact, the note-issuing rights of the "Enskilda" banks lapsed on August 1 1903).

Present Administration and Business Activity of the Riksbank.

The principal stipulations respecting the administration and business activity of the Riksbank are to be found in part in the Fundamental Laws of the Realm, in part in an Act of the Riksdag passed May 12, 1897; the latter has been to some extent modified since by amending clauses being added, the last dated Aug. 31, 1914. Consequently those principal stipulations are the result of the joint legislative work of the Riksdag and the Government. There exist, however, supplementary stipulations respecting the more detailed organization of the Riksbank over which the Riksdag alone exercises control.

The Court of Directors *(Styrelsen)* consists of seven members who bear

the title Bankofullmäktige, Riksbank Commissioners. One of their number, the Chairman, is nominated by the King, the others by the Riksdag in accordance with the recommendations of an ad hoc selecting committee. The Court of Directors elects from among those of its members chosen by the Riksdag three Delegates *(Deputerade)*, to act as the managing directors of the Bank. A member of the Bank Court is not permitted to be on the board of directors of any other bank unless it be a savings-bank or the Post-Office Savings-Bank.

The *capital* of the Riksbank is fixed at 50 million kronor. At least 10 per cent of the annual profit is to be passed to the *reserve fund*, until the latter has become equal to 25 % of the capital (since 1909 the reserve fund has been 12·5 million kronor). Otherwise the Riksdag has the right of disposal of the annual profit. — The Riksbank's note issue is restricted in the following manner: it is allowed to issue notes to the extent of: *a)* double the amount of the gold held by the Bank (which in case of a fall below 75 million kronor must be restored to that minimum as soon as may be), and *b)* 125 million kronor beyond that amount. To this, however, the condition is attached, that the notes issued beyond the amount of gold held shall be backed by: (1) readily negotiable Government Securities, (2) bonds issued by the General Mortgage Bank, the National Town Mortgage Bank of Sweden, or other Swedish bonds quoted on foreign Bourses, (3) gold deposited at some place abroad or in process of conveyance therefrom, (4) bills of exchange payable within or without the country, (5) a credit balance at some bank or accepting-house abroad maturing within six months, or (6) money advanced against securities or bonds mentioned in (1) and (2) above. The bank-notes, which on presentation are redeemable in gold at the head office of the Riksbank, are legal tender throughout the country. Under ordinary conditions the five-kronor note is the smallest note issued by the Riksbank.

Chiefly to enable the Riksbank to increase its covering for its notes, the Bank is entitled to avail itself of *foreign credit* to the extent determined by the Riksdag in its Bank Regulations (at present 20 million kronor). The same purpose is answered by the provision that the Bank shall hold readily negotiable foreign assets to an amount at least equal to the reserve fund.

The Banking Business of the Riksbank. The Riksbank is entitled to buy and sell gold and silver, Swedish bonds, and readily negotiable foreign government securities quoted on foreign Bourses, while in virtue of another agreement it is authorized to take over Swedish Government bonds and easily negotiable foreign Government securities as well as to negotiate the purchase and sale of Swedish Government bonds and the bonds issued by the General Mortgage Bank. The Riksbank is furthermore empowered to discount, or buy and sell, domestic and foreign bills with at most six months to run; to make loans for at most six months on bonds, shares, and other paper securities and commodities; to make loans on

bonds, shares and other securities for an unlimited period but subject to at most three months' notice; to open cash or current account credits for at most twelve months against such collateral pledges as bonds, shares, or mortgages or against the security of guarantors. The maximum amount, however, that the bank is permitted to invest in this last-mentioned loan business is 15 million kronor.

The Riksbank has under its care and management a special fund (called the *avbetalningslånefonden* or instalment-redemption loan fund), with a capital of 12·5 million kronor, from which it makes advances to be paid back by instalments on such collateral pledges as bonds, shares, mortgages, or on the security of guarantors.

The Riksbank issues bank post bills *(postväxlar)* and accepts deposits both on deposit and on cheque account. The Riksbank as a general rule is not permitted to give interest on deposits; it is allowed, however, to open a current account at interest for firms that discount their bills at the Riksbank and do not engage in banking business themselves. In connection with its cheque transactions the Riksbank is entitled to arrange for clearing, and the bank has availed itself of this right: by agreement with the larger banks in Stockholm a clearing-house system has been established, in which all the banks in Sweden directly or indirectly participate. — The Riksbank acts as a depository of articles of value for safe custody and of securities etc., which it preserves and administers on behalf of their owners. It is one of its functions to do duty as the Government's banker free of charge; no overdraft is allowed, however, on any of the various Government accounts, except in the case of the National Debt Board, which in its administration of the National Debt is entitled to avail itself of an overdraft to the amount of $1^1/_2$ million kronor.

The Riksbank is bound by law to have at least one branch office in each län, except in Stockholm län, thus altogether at least 23 branch offices; at present it has 25.

The Riksbank is not permitted to hold other real property than its own premises (head offices, branch offices, paper manufactory, printing works). — A weekly return of the Riksbank's holding of gold, silver and bullion, of the total notes in circulation, and of the unutilized power of note issue is to be published in the Official Gazette. The Riksbank must publish and distribute as a supplement to the Official Gazette at the end of every month an account of its assets and liabilities, and at the close of every year a complete report of the Riksbank's position.

Other Banks.

The law now in force respecting other banks than the Riksbank is contained in the Banks Act of June 22 1911.

Pursuant to this Act, banking business in Sweden may only be carried on by 1) the Riksbank, 2) joint-stock banks 3) unlimited liability banking companies,

Office-room of the »Nordiska Kreditbanken» in Stockholm.

and 4) private persons or partnerships *(handelsbolag)* in which personal names form a constituent part of the firm-name. Banking business within the Act is such business as comprises the receiving of deposits *from the general public* on such accounts as customarily occur. Thus cooperative societies are not banks, if the receiving of deposits that they carry on is confined to the members of the society. The term *bank* may only be used in the firm-name by 1) the Riksbank, 2) the joint-stock banks, 3) the unlimited liability banking companies, 4) underwriting banks (*emissionsbank*),[1] 5) the Post-Office Savings-Bank and other savings-banks, and 6) the Iron Institute (*Jernkontoret*) and the General Mortgage Bank. — If the banking company in question is considered likely to be of the benefit to the public, and if its articles of association are in accordance with the law of the land, the Government grants it a charter (*oktroj*) for ten years. (It is thus open to the Government to prohibit the formation of either a limited or an unlimited liability banking company, when any such company is manifestly *not* for the benefit of the public.) The company's capital shall be at least a million kronor; however, if the bank has manifestly been established to serve the needs of a locality with a slender business turnover, the minimum capital may, subject to the sanction of the Government, be fixed, at half the above amount. The firm-name of a joint-stock bank shall indicate the fact of the liability of the shareholders being limited. The firm-name of unlimited liability banking companies whose capital

[1] The purpose or scope of this type of bank, which was created (at any rate on paper) by a special Act of 1909, is to assist (by the underwriting of shares) in the formation or constitution of joint-stock trading companies.

is not less than a million kronor shall contain the words "enskild bank"; if the capital is below that amount, it shall contain the word "folkbank" (people's bank). The shareholders in limited liability banking companies must be of Swedish nationality, and number at least twenty. An unlimited liability banking company must consist of at least thirty principal stockholders, who must be of Swedish nationality, and the principal stockholders are liable jointly and severally for all the commitments of the company. (The procedure by which the creditors of the company can enforce this liability is laid down in the Unlimited Liability Banks Bankruptcy Act of the Sept. 18 1903.) Every principal stockholder shall file with the banking company a signed and attested document stating the amount of stock he holds. A stockholder is not entitled to withdraw from the company during the term of the charter, unless he obtain the company's express consent. The principal stockholders may, if they so desire, associate with themselves a number of limited liability stockholders *(kommanditlottägare)* — whose holdings may amount to half the original subscribed capital; such stockholders are not liable for more than they have invested or engaged to invest in the company. The shares in joint-stock banking companies and the stock in unlimited banking companies shall be personal and inscribed. (The shares of certain earlier joint-stock banking companies are still drawn out to bearer.) The board of directors is under the obligation to keep a share or stock transfer register *(aktiebok* or *lottbok)*, in which all transfers of shares and stock shall be immediately recorded. This transfer register shall be open to the inspection of the public during banking hours. — Out of the annual profit at least 15 % shall be appropriated to the reserve fund, as long as the latter does not amount to 50 % of the original subscribed capital. — As regards *the business of banking* the following enactments are in force: A banking company is only entitled, on its own account, to *trade* in gold, domestic and foreign coins, bills, cheques, drafts, and bonds. (With regard to the right of certain banks to deal in stocks and shares, see below.) A banking company is not permitted to acquire any real property except for its own premises. However, a banking company is permitted to take over personal or real property to cover an outstanding claim, if otherwise loss would manifestly be incurred. A banking company is not permitted to acquire or receive as a security its own shares, and an unlimited liability banking company is not permitted to acquire or receive by way of security its own stock or the principal stock of another similar banking company. A banking company whose reserve fund exceeds 50 % of the original capital is entitled to invest any surplus beyond that figure in the shares of an underwriting bank. Moreover, if the original capital and the reserve fund of the banking company amount together to at least six million kronor, the banking company is entitled to hold other shares up to half the amount of the above-mentioned surplus for which the right to hold shares in an underwriting bank has not been utilized. — The amount received by the banking company in the form of deposits shall not exceed five times the amount of the company's own funds, besides which the banking company shall in its till or in readily negotiable assets show a *cash reserve* to the extent of at least 25 % of the bank's liabilities at call. In deposits repayable after expiry of notice the certificate issued by the bank shall be drawn out to a definite person named and shall contain the stipulation that any transfer must be by endorsement to a definite person named. On a customer's savings-bank account interest is only payable on deposits not exceeding 3 000 kronor. A banking company shall not engage to repay deposits on a savings-bank account without at least a week's notice; moreover every deposit and every withdrawal shall be entered in a pass-book to be supplied by the bank to the holder of the account.

Bank Inspection. The inspection of banks devolves upon a special office

designated *Bankinspektionen,* the Bank Inspection Board instructions for the conduct of which have been issued by the Government. The inspection is effected firstly by monthly reports, drawn up in accordance with a prescribed form and lodged with the Bank Inspection Board, secondly by a representative appointed for each bank, who has to take part in the annual auditing and at least once every quarter take stock of the cash in the till at the bank's head office, examine whether the report last made agrees with the accounts, and in case of anything being found wrong at once report the matter to the Bank Inspection Board, and finally by personal supervision carried out by one of the members of the Board. The Board is entitled to convene meetings of the board of directors of the bank, and in certain cases also extraordinary shareholders' meetings. A member of the Board is entitled to be present at the shareholders' meetings, and at board meetings summoned by the Bank Inspection Board, and to take part in the proceedings. If the Board finds cause to assume that 10 % of the original capital (apart from the reserve and other funds) has dwindled away in consequence of losses, the board of directors will be under the obligation, when called upon by the Bank Inspection Board to do so, immediately to draw up a balance-sheet and to summon the auditors. The Bank Inspection Board is empowered to veto a resolution of the board or of a shareholders' meeting which infringes the law or the company's articles of association. In the case of grave transgressions of the Banks Act or the articles of association of the company, it is open to the Government to declare the charter rescinded. — The expenses of bank inspection are at the charge of the banks themselves, each bank contributing an annual fee of at most $^{1}/_{100}$ % of the aggregate amount of the bank's funds (at present the contribution is fixed at $^{7}/_{1000}$ %).

The above account of Swedish banking legislation will have made it evident that the object it has had in view has been to ensure the stability of the banks in their capacity as banks of deposit. The clause in the 1911 Banks Act, according under certain provisoes the right to banks of dealing in stocks and shares on their own behalf, is as a matter of fact of little importance. Out of the banks at present (October 1914) existing, numbering 70 with a total capital of upwards of 660 mill. kr., there are only 20 that fulfil the requirements entitling them to deal in stocks and shares, while the total amount set apart for use in this direction is only 38 mill. kr. At the time named the total holding of stocks and shares in the banks' own possession stood entered in the books as amounting to 13 mill. kr. in value, i. e. insignificant sums as compared with the advances that the banks had granted to their customers at the same juncture, the total of which was close upon 2 400 mill. kr. Of that amount, however, 734 mill. kr. consisted of advances made on the security of stocks and shares. Besides the banks held bonds for an entered value of 225 mill. kr.

Though the Swedish banks, consequently, by buying bonds and by making advances on stocks and shares, have rendered service to the industries of the country, yet they have not been in a position to help them as effectively, for instance, as the German "Effektenbanken". This has moreover been recognized as a drawback, and efforts have been made to remove it.

The Underwriting Banks Act of 1909, above referred to, was designed to

facilitate the formation of banks whose functions should principally, if not exclusively, consist in the financing of industrial undertakings. No such bank, however, has been started, a fact that is probably due to the very rigorous terms prescribed by the Act respecting these banks, more especially the item that only banks were entitled to be shareholders in an Underwriting Bank. The difficulty has been practically obviated by ordinary companies being formed to finance industrial enterprises, such companies being governed of course by the laws affecting limited liability companies. Such banks as are entitled to possess shares can then become shareholders in any such company. Among the companies of this type the best known are: Svenska Emissionsaktiebolaget, Aktiebolaget Providentia, Aktiebolaget Svenska Emissionsinstitutet, and Finansaktiebolaget.

The principal activity of the banks consists in making advances for short periods with the money deposited with them by the public. The different forms of deposit business are as follows: a) *Deposit Accounts,* under two headings, depositionsräkning and kapitalräkning, the difference between which is only of a formal kind, for sums that are to be repaid at a given date or stated notice; b) *Accounts Current* or *Cheque Accounts,* for money to be repaid at call; and c) *Savings-Bank Accounts,* for money deposited on conditions which are practically the same as those in force for Savings-Banks.

Advances are usually made in one of the three following ways: a) The *discounting* of bills; b) the granting of *loans* on the security of mortgages, debentures, stocks, and shares, etc., or on personal guarantee; c) the allowing of *overdrafts* or *cash credits* on similar security. Another form of account is the running account, practically a combination of cheque account and cash credit, enabling the customer, in accordance with agreement and on security lodged, to overdraw his account at the bank up to a stipulated amount.

The various articles of association of the banking companies, which have been duly authorized by the Government, embrace a prohibition for the several banks to discount bills or to accord loans for a longer space of time than six months, or to grant the right to overdraw an account for more than one year. Some banks, however, are also entitled, subject to certain restrictions, to grant loans repayable by instalments for at most ten years. The several articles of association likewise contain a prohibition on banks granting credit on the security of only one guarantor's name.

The banks carry on besides a number of other branches of activity. Thus, they *issue bank post bills* (generally speaking sight drafts drawn on some Stockholm bank, which according to mutual agreement among the banks are cashable at any banking establishment throughout the country); they also *issue letters of credit* to travellers, payable at any of the more important towns on the continent, undertake the *collecting of matured bills,* dividend warrants, drawn bonds etc., *accept securities* depo-

TABLE 140. *Summary of the Financial Position of Swedish Banks on October 31 1914 (in millions of kronor).*

Assets and Liabilities	The Riksbank	Other Banks	Total
Assets.			
Gold and Bullion	103·941	0·896	104·837
Bills etc., payable at sight	1·719	37·162	38 881
Other Legal Tender	8·114	11·248	19 362
Bank Premises and Furniture	—	66·333	66·333
Bonds and Government securities	30 044	224·699	254·743
Shares	—	16·851	16·851
Claims on Swedish Banks	—	41·264	41·264
» » Foreign Banks	19·960	104·244	124·204
Bills payable in Sweden	117·782	607·500	725·282
» » Abroad	45·264	23·949	69·213
Outstanding Loans	40·611	1 265·555	1 306·166
Cash Credits and Overdrawn Current Accounts	2·971	514·441	517·412
Sundries	69·627	82·383	152·010
Total	440·033	2 996·525	3 436·558
Liabilities.			
Notes in Circulation	284·030	—	284·030
Bank Post Bills in Circulation	1·023	39·138	40 161
Current Accounts	58·381	272·727	331·108
Deposit Accounts	—	1 149·605	1 149·605
Deposits on Savings-Bank Accounts	—	372·389	372·389
Liabilities to Swedish Banks	—	143·019	143·019
» » Foreign Banks	17·343	88·032	105·375
Loans Raised	—	133·951	133·951
Sundries	7·956	141·174	149·130
Original Subscribed Capital	50·000	379·577	429·577
Other Funds	21·300	276·913	298·213
Total	440·033	2 996·525	3 436·558
Note Issue	332·882		
Unutilized Note Issue	48·852		

sited for safe custody and administration, and *carry out the sale and purchase of securities* on commission for customers.

Of the eminent men who have furthered the development of banks and banking most effectively *A. O. Wallenberg* (d. 1886) is indisputably the foremost; the Stockholms Enskilda Bank was his creation. Others deserving mention are *Theodor Mannheimer* (d. 1900), *Louis Frænkel* (d. 1911), *K. A. Wallenberg* (at present Minister for Foreign Affairs) and *Marcus Wallenberg.*

Of the Swedish banks other than the Riksbank the three following possess funds amounting to upwards of 50 million kronor, viz. the *Skandinaviska Kreditaktiebolaget*, 93 million kronor, the *Stockholms Handelsbank*, 66 million kronor, and the *Stockholms Enskilda Bank*, 52 million kronor. The three banks mentioned are moreover those that most frequently participate in the large financial transactions that are from time to time inaugurated, latterly often in conjunction with *Aktiebolaget Sveriges Pri-*

vata Centralbank, a banking company founded in 1912 as a central organ for a considerable number of average-sized provincial banks.

3. MORTGAGE INSTITUTIONS.

The mortgage banks in Sweden which serve the purposes of agriculture have been already dealt with in a separate section (pp. 135 foll.). The most important of the other banks of this type are *Konungariket Sveriges Stadshypotekskassa* and *Stockholms Inteckningsgarantiaktiebolag*.

Konungarikets Sveriges Stadshypotekskassa, The National Town Mortgage Bank of Sweden, is managed in accordance with a Royal Ordinance of June 5 1909 and the Regulations issued by the Government on January 18 1910. Its capital, which has been handed over to it by the State in the form of $3^1/_2$ % bonds, amounts to 30 million kronor. The functions of the bank consist in negotiating requisite loans for mortgage societies constituted of owners of real property in towns and communities comparable to towns. This bank is thus to the town mortgage societies what the General Mortgage Bank is to the rural mortgage societies. The bank is administered by a board consisting of five members, four of which are appointed by the Government, and one by the National Debt Board. The administration of the board is subject, to the inspection of three auditors, two of whom are nominated by the Government and one by the National Debt Board. The Government determines after hearing the opinion of the National Debt Board, whether the board's administration is to be approved.

Stockholms Inteckningsgarantiaktiebolag, the Stockholm Mortgage Security Company Ltd, also transacts banking business and is therefore included among "other banks" in Table 140. The original object for which the Company was formed was "to guarantee the repayment when due of the capital sums, either with or without interest, advanced in the form of loans on promissory notes secured upon real estate in the compass of the City of Stockholm and by that means to facilitate the procuring of loans of that nature". The company also supplies loans for building purposes. It has done very much for the organization and strengthening of credit based on real property in Stockholm. The share capital is 15 million kronor, and the aggregate funds amount to 25 million kronor.

Mortgage Security Companies (*Inteckningsbolag*) have also been formed at Gothenburg, Gävle, Malmö (the Skånska Inteckningsaktiebolaget), Hälsingborg, and Örebro.

For some figures, see p. 139.

4. SAVINGS-BANKS AND SIMILAR INSTITUTIONS.

The oldest **savings-bank**, in the strict sense of the term, founded in Sweden is the Gothenburg savings-bank, which was opened on the 28 October 1820. The city of Stockholm Savings-Bank was established in 1821, and during the latter twenties of the nineteenth century similar in-

stitutions were set up in most of the provinces of Sweden, though in the northernmost provinces not till the close of the forties and the commencement of the fifties. The Province in which the savings-bank system first won extensive dissemination was Malmöhus Län, where as early as 1850 fourteen savings-banks of some size and importance had been established.

The following figures exhibit the growth of the savings-bank system since 1860.

Year	Number of Savings-Banks	Number of Depositors (pass-books)	Balance of Depositor kr.	Average Balance, kr.: per Pass-book	per Head
1860 . . .	149	187 675	27 291 937	145	7
1870 . . .	234	353 867	57 301 804	162	14
1880 . . .	340	762 638	146 071 708	192	32
1890 . . .	378	1 072 735	275 039 102	256	57
1900 . . .	388	1 228 930	437 391 160	356	85
1905 . . .	415	1 374 632	601 751 390	438	114
1910 . . .	436	1 560 317	808 788 530	518	146
1911 . . .	438	1 612 113	857 007 143	532	154
1912 . . .	438	1 664 163	904 235 925	543	161
1913 . . .	440	1 717 694	952 605 043	555	169

Out of the savings-banks existing in 1913, reckoning according to the situation of the head office, 112 belonged to the towns and 328 to the country.

The Swedish savings-banks are institutions for the benefit of the public, but of a private nature, and with an almost unlimited range of liberty as regards administration. They are distinguished in this respect from the savings-banks of other countries: from those of Great Britain and France, which are obliged to place their monies under the custody of the Government, or to invest them in Government papers; from those of Belgium, whose *Caisse générale d'épargne et de retraite* is a Government institution (which collects deposits partly through the post offices, and is thus in a manner a post office savings-bank); and from those of the German states, where the administration of the savings-banks often devolves on the commune. The first Swedish Savings-Banks Act, that of 1875, taboos the making of dividends in the case of savings-banks. The Act now in force, that of 1892, defines a savings-bank as a monetary institution, which, without right for the founder or his assigns to derive any benefit from the business, has for its object to receive money from the public at simple and compound interest, and repay it on due notice being given. Moreover, it is prescribed that no other financial institution may carry on business under the designation of savings-bank, without special authorization.

Foundation Capital and Reserve Funds. The foundation capital and the reserve funds of the Swedish savings-banks corresponded during the early nineties, according to an average computation, to approximately 9 per cent of the balance of the depositors, but after 1895 this average dwindled for a series of years with almost steady persistence. After 1906, however, the average has remained almost stationary; in 1913 it was 8·1 per cent. The decrease in the ratio between the funds and the deposits derives its explanation from the rapid growth of the deposits,

with which the distribution to the funds was unable to keep even pace. — The following summary shows the different kinds of *investments.*

	1880	1890	1900	1910	1913
Bonds, outstanding claims on communes and the like	16·04 %	11·60 %	16·48 %	13·79 %	14·91 %
Outstanding claims on private persons:					
against mortgages	42·70 »	51·54 »	51·37 »	56·11 »	57·21 »
against sureties	30·76 »	24·61 »	17·98 »	16·43 »	14·80 »
Cash and other accounts	10·50 »	12·25 »	14·17 »	13·67 »	13·08 »

It will be seen from the above summary that the outstanding claims backed by guarantor have been relatively decreasing, whereas investments in mortgages have been coming into more and more extensive use. However, the loans made against backers' names still bulk pretty largely in the minor savings-banks located mostly in the country, where there is a personal bond between the bank and its customers. According as the banks increase in size, transactions of this kind are seen to figure less prominently and the money which the public has entrusted to the bank will be invested preferably in mortgages or in bonds. In 1913 the figures worked out as follows:

In Savings-Banks where the aggregate Balance of Deposits was	Bonds, communal claims etc.	Claims on private persons against: Mortgages	Mortgages and Guarantors Securities	Guarantors Securities	Cash and other Accounts
Under 50 000 kr.	0·29 %	35·23 %	2·68 %	54·04 %	7·76 %
50 000— 100 000 »	2·43 »	37·15 »	8·85 »	43·23 »	8·34 »
100 000— 250 000 »	4·90 »	38·59 »	9·58 »	38·16 »	8·77 »
250 000— 500 000 »	4·03 »	38·89 »	7·74 »	38·76 »	10·58 »
500 000—1 000 000 »	4·75 »	41·52 »	8·29 »	34·54 »	10·90 »
1 000 000—5 000 000 »	9·58 »	46·23 »	9·19 »	20·57 »	14·43 »
Over 5 000 000 kr. . .	20·10 »	55·30 »	4·63 »	7·22 »	12·75 »

The *expenses of management* of the savings-banks amounted in 1913 on an average to 0·43 %, in ratio to deposits, and formed 1·09 % of the total amount of money passing through the hands of the bank.

The *rate of interest* for deposits was on a general average for the savings-banks of 1913 4·49 % (effective interest 4·48 %), though with great fluctuations for banks of different size. In 39 savings-banks in which the average of the deposited capital was about 1 825 000 kronor, the interest was 4 %, in 311 savings-banks with an average capital of about 2 560 000 kronor, it was 4½ %, and in 73 savings-banks, in which the capital deposited was on an average 814 000 kronor, the interest was 5 %. — The apparent anomaly that the smaller savings-banks, in spite of their comparatively heavy working expenses, can afford to give a higher interest than the bigger banks, is readily accounted for by the nature of their loan transactions. It has been explained above that it is especially the smaller banks that carry on the more lucrative business of lending to customers on the security of backers' names.

The new schedules prescribed for savings-bank returns have enriched savings-banks statistics with a fresh body of data. Of very particular interest are the data relating to the interest charged on loans to customers. In 1913 the lowest, generally adopted, rate of interest for loans against mortgages was 5 %. In loans granted on the security of guarantors the rate of interest was higher, as a rule by a half or one per cent.

In 1884 the **Post-Office Savings-Bank** was founded. This institution, which receives deposits and makes payment (after due notice) through the Post Office, belongs to the State, which has entered into a guarantee for the security of the money deposited in it. The administration of the Post-Office Savings-Bank is in the hands of a Board composed of the Postmaster-General, in the capacity of Chairman, and four members: notably one Bureau Chief in the Post Office Board, who is told off as adviser in savings-bank matters, one member nominated by the King, one of the Commissioners (directors) of the Bank of Sweden, and one of the National Debt Board. — The progress of the Post-Office Savings-Bank system is exhibited by the following figures, giving the averages for some years:

Year	Number of Offices	Number of Pass-books	Depositors' Balance, kronor	Average Balance, kr.: per Pass-book	Average Balance, kr.: per Head of pop.
1884 . . .	1 575	79 513	827 641	10·41	0·18
1890 . . .	1 942	237 060	13 016 554	54·91	2·72
1900 . . .	2 652	566 805	56 461 391	99·61	10·99
1910 . . .	3 245	557 337	46 253 411	82·99	8·37
1911 . . .	3 286	565 759	47 186 406	83·40	9·42
1912 . . .	3 328	569 534	47 716 785	83·78	8·51
1913 . . .	3 360	575 700	48 075 655	83·51	8·53

It will be seen that the Post-Office Savings-Bank has not made very rapid progress. Indeed, during the last decennium there has been a backward ebb, as will best be realized by comparing the withdrawals and the deposits. In 1900 the withdrawals were as much as 140 % of the deposits; the difference between them was close on $5^1/_2$ million kronor. In 1913 the corresponding figures were 109·00 %, and somewhat over $1^1/_4$ million kronor.

In Sweden the Post-Office Savings-Bank has been particularly appreciated in sparsely populated regions, which, but for its existence, would have had to do without a savings-bank. But, owing to the advantages it holds out, the chief of which is its ready accessibility, it has managed to thrive pretty well in places well supplied with private savings-banks.

As regards the *balance per pass-book*, it is interesting to compare the Post-Office Savings-Bank with the private savings-banks. Whereas in the private savings-banks the average value of a pass-book has been gradually rising, the development in the case of the Post-Office Savings-Bank has gone in the reverse direction. It is true that the average value of these pass-books steadily rose from 1884, when it was 10·41 kronor, up to 1899, when it was 107·69 kronor; but afterwards it sank steadily (except for the years 1903—04), down to 1909, when it was 81·73 kronor. In recent years there has been a slight rise. — The chief mission of the Post-Office Savings-Bank from the very outset was to form an always getatable and absolutely safe savings-bank for persons of small means, and particularly for the rising generation. During the first years of its existence, however, the Post-Office Savings-Bank did not make any tangible progress in this regard. The sale of savings-

bank stamps *(sparmärken)*[1] during the period from 1888 to 1892 figured out at an average 4 304 078, but during the quinquennial period from 1898 to 1902 had no risen to more than to 4 653 073. Since then, however, there has been a fairly large rise; during the years from 1908 to 1912 6 535 730 *sparmärken* were sold.

Out of the pocket money-boxes *(ficksparbössor)* kept by the Post-Office for sale of loan, at the end of 1912, 46 926 had been supplied to the public, out of which 22 375 were lent and 24 551 sold.

The *rate of interest* given by the Post-Office Savings-Bank was 3·6 % up to the end of 1896, was then reduced to 3·3 %, but since the 1st July 1899 has again been raised to 3·6 %. The rate is thus lower than the average rate of the savings-banks (4·36 % in 1912), and considerably lower than the interest paid by the smaller savings-banks to their depositors — an inevitable consequence of the stringent regulations to which the Post-Office Savings-Bank had to submit. Prior to 1902 the Post-Office Savings-Bank was not permitted to invest its monies in anything but Government bonds, General Mortgage Bank bonds, and communal bonds, or in communal loans issued on the security of promissory notes *(skuldebrev)*. In 1902, however, the Post-Office Savings-Bank acquired the right to lend, at most, a quarter of its capital against promissory notes on the security of mortgages. As to *expenses of management*, they amounted in 1912 to 0·65 % of the pass-book balances, and were thus relatively speaking, far higher than those of the private savings-banks (0·44 % in 1912). It should, however, be borne in mind that the average per pass-book in the Post-Office Savings-Bank was only 83·48 kronor, whereas in the case of the private savings-banks, it was 543 kronor; if one estimates the costs in ratio to the sums passing through the hands of the banks, they are 1·12 % for the Post-Office Savings-Bank, but 1·10 % for the private savings-banks.

People's Banks. The people's banks had much the same aims as the savings-banks. By the Banks Act of 1903, they were deprived of the right to bear that name (after 1903 only financial institutions for which regulations have been drawn up by Government are entitled to the designation "bank"). The former people's banks have consequently been rechristened with new names such as *kreditbolag*, credit company, *folkkassa*, people's fund, *sparkassa*, savings-fund, and the like. Savings-bank operations only form part of the business they transact: besides this, they also discount bills. Unlike the savings-banks, these institutions do not solely serve the public benefit: they are regular business undertakings, though only on a minor scale, giving dividends, and looking to the advantage of their shareholders. An Act of 1903 had provided for the due supervision of these institutions.

In 1913 there were 26 of these institutions, all of them being in the country. The number of depositors on "savings-bank account" was 20 744, and their total balance at the close of the year 9 193 683 kronor. The ave-

[1] In order to provide facilities for the collection of petty sums, savings-bank stamps (*sparmärken*) worth 10 öre each are kept for sale by the post office, by rural postmen, and by dealers. These are affixed to a cardboard sheet, which, when the amount totals a krona, can be handed in as a deposit at the nearest post office.

rage value of a balance was 443·19 kronor, that is 112 kronor lower than the value of a savings-bank book.

In the middle nineties the savings-banks were saddled with a competitor in the savings-bank business transacted by the **joint-stock banks.** The first start in this direction was made in 1877, but it was not until 1869 that the movement began to assume momentum. At the close of that year the deposits — not counting the savings-bank business transacted by the people's banks — amounted only to 9·1 million kronor. In 1897, when the unlimited banks began to arm themselves for the coming abolition of private note issue, some of them also opened up a savings-bank account. Thus, the number of banks with savings-bank accounts rose in the course of that year from 9 to 20, and the deposits on savings-bank account swelled from about 21½ million kronor to about 34 million kronor. 9 years afterwards, that is, the end of 1908, when the number of banks had risen to 84, all of them had savings-bank accounts, the deposits had swelled to 251 million kronor, and the number of depositors' accounts to over 681 000. The progress of the development is shown by the following figures:

At the End of the Years	Number of Account-holders	Balance of Capital Deposited, kronor	Average Sum per Account-holder kr.
1900	183 226	90 680 166	495
1905	407 493	184 090 100	452
1906	476 175	203 456 900	427
1907	560 756	230 735 000	411
1908	647 846	249 342 300	385
1909	710 227	267 306 800	376
1910	756 089	279 218 900	369
1911	821 448	303 107 000	369
1912	890 020	331 194 100	372
1913	955 002	351 711 100	368

The chief cause of this rapid increase of the capital deposited in the banks on "savings-bank account" — an augmentation which has greatly told on the Post-Office Savings-Bank, the larger savings-banks, and has affected the current accounts of the banks themselves — is to be ascribed to the severe competition prevailing between the many new joint-stock banks which had latterly been formed, and especially in 1896. Even the older joint-stock banks were carried along in the sweep of this movement. Its outward symptoms, during the period of monetary tightness which afterwards ensued, were the high rate of interest and the other advantages held out by the banks to depositors on savings-bank account.

The Cooperative Union. Savings-bank business is also transacted by the Cooperative Union *(Kooperativa Förbundet)* since the end of 1908. From 1912, when the new Banks Act came into force, the right of deposit was restricted to organizations connected with the Union and to their members. In other respects, the regulations affecting the savings-banks apply as a whole also to the Cooperative Union. At the close of 1914 the total amount balance of deposits on savings-bank accounts was 2 161 365

kronor, distributed over 10 978 pass-books. The average balance per pass-book was 196·88 kronor.

Also a number of those smaller cooperative societies which are in Sweden called *konsumtionsföreningar* have savings-funds. Their balance at the end of 1913 was about 100 000 kronor.

Aggregate amount of deposits on savings-bank account on the 31 December 1913:

In private savings-banks	952 605 043 kr.
In the Post-Office Savings-Banks	48 075 655 »
In institutions equivalent to savings-banks	9 193 683 »
In private banks and joint-stock banks	349 420 213 »
In the Cooperative Union etc.	1 816 921 »
Total	**1 361 111 515** Kr.

Deposited the same time in the banks (inclusive of the Bank of Sweden):

On deposit account	1 115 112 512 kr.
On drawing (cheque) or current Account and folio Account	227 456 647 »

It will be seen from these figures that the amount deposited by the public on savings-bank account is about as large as the total amount of their other deposits. The explanation of this is that in Sweden, as in other countries, savings-bank business comprises — besides savings-bank business in the strict sence of the term, that is, the saving up of small sum to form capital, — two other branches of business. It includes also the investment of capital *already formed* (that is, what is generally known as deposit account) and moreover a kind of domestic petty cash business corresponding to the drawing account of business life proper (and in a few cases real drawing account business). One may regard as in the light of already formed capital at any rate a number of the balances of more than 2 000 kronor in the savings-banks. In 1913 balances of this size aggregated no less than 493 712 815 kronor, or 54·6 % of the total balance. For domestic petty cash accounts the Swedish public resorts chiefly to the savings-bank departments of the banks, and not so much to the private savings-banks, which are tramelled with rather onerous regulations as to notice, or to the Post-Office Savings-Bank. This is brought out by the ratio of the withdrawals to the balance, being in 1913 19·46 % in the private savings-bank and 31·2 % in the Post-Office Savings-Bank.

In order to obviate the savings-banks being used for investments of capital, most of the savings-banks have made regulations whereby a certain limit is fixed after which no interest is paid on deposits, this limit being usually 2 000, 3 000, or 5 000 kronor. But in some cases the limit is as high as 10 000 kronor, or even extends to 50 000 kronor, especially in the rich southern provinces. In the case of the Post-Office Savings-Bank the limit is fixed (since 1891) at 2 000 kronor, and since 1900 the banks have been prohibited from receiving higher amounts than 3 000 kronor at interest on "savings-bank" or similar accounts. This prohibition appears to be also aimed at the abuse of depositing on savings-bank account, money which ought to have been deposited on drawing account. — To prevent savings-banks being used as "petty cash"

institutions for deposits of a more or less temporary nature, the Savings-Banks Act interposes the restriction that savings-banks shall not engage to repay money deposited, except after due notice received (it being open however to the directors to concede repayment before the termination of the term of notice, where this can be done without inconvenience). The same provision, with the supplementary regulation that the term of notice shall be at least a week (with similar authorization for the directors to allow exceptions) also applies since 1900 to the savings-bank accounts of the ordinary banks. However, it appears to be still the general practice of the banks to repay on demand money deposited on savings-bank account. As to the Post-Office Savings-Bank, its pass-books can be used for deposits and withdrawals in any post office in Sweden. The obvious corrolary is that money deposited in the Post-Office Savings-Bank cannot be withdrawn without notice and without an order from the head office to make the payment.

As to the aberrations above touched upon in the savings' bank system, it may be said that, with the exception of actual drawing account business, they are intrinsically quite legitimate forms of savings-bank business. What is wrong is the absence of special conditions and regulations for each of the different branches of business. But this defect is capable of being remedied. Though it must perhaps be admitted that the deposit account is better fitted than the savings-bank account for the investment of real capital, it should not be forgotten that it is the large balances, which cost less to manage, that make it possible for the savings-bank business to subsist with the comparatively high interest they at present give. On the other hand, it can hardly be contested that an account separate from the current account, for withdrawals at call, and intended for household purposes, would prove a great boon especially to salaried persons, small tradesmen, and the industrial classes.

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5. INSURANCE.

Insurance Legislation in Sweden (except as regards maritime insurance, which is provided for in Chapter 12 of the Maritime Law of 1891 common to Sweden, Norway and Denmark) is substantially contained in the Insurance Act *(Lag om försäkringsrörelse)* and in the Act relating to the Right of Alien Insurance Companies to transact Insurance Business in Sweden, both of which Acts were issued on the 24th July 1903.

The Insurance Act.

Insurance business, except as regards insurance institutions established by the State, shall be transacted only by *insurance companies*, or by a company or society the constitution of which provides for the mutual liability of the shareholders *(mutual insurance company)*.

The general provisions of the Companies Acts do not apply to insurance companies: The Insurance Act contains corresponding regulations regarding the formation and registration of insurance companies, the formulation of the articles of association and modifications therein, shareholders' meetings, and the general administration of the company and auditing, as well as regards bankruptcy and winding up. As the regulations in question are different for joint-stock com-

panies, and other companies, this part of the law consists of two main divisions with parallel regulations for the two different kinds of insurance companies.

In addition to this, the Act contains the provisions which the peculiar character of insurance business, and particularly life insurance, render necessary. In this respect the nucleus of the Insurance Act consists of the regulations intended to ensure that the insurance fund shall be reserved as far as possible for the benefit of the insured. The amount of the premium reserve, the essential part of the insurance fund, shall thus be estimated in accordance with certain principles laid down by Government. The insurance fund shall be invested in certain safe securities, which shall be kept under lock and key by a public official, the policy-holders having a lien on them, as in the case of a pledge actually in their hands. Moreover, in order to safeguard the interests of the insured, the Company shall appropriate a certain amount of its capital to a safety fund, which, subject to penal presecution, shall not drop below a certain percentage of the insurance fund.

Furthermore, a Board of Insurance Inspection with extensive powers has been established for the supervision of insurance establishments and the maintenance of the publicity essential for the benefit of the public.

Of particular importance are the measures adopted for the inspection of insurance companies in the event of their being wound up or adjudged bankrupt, — in which cases a special procedure is adopted — and with regard to the voluntary transference of the life insurance policies. In both these cases the intention of the law is to safeguard to the greatest possible extent the rights of individual policy-holders while keeping the insurance stock on the basis of the insurance fund.

Alien Insurance Companies Act.

If an alien insurance company desires to carry on insurance in Sweden, they shall make application through a general agent possessing certain necessary qualifications, in the capacity of trustee; further, prior to starting insurance operations, certain documents, powers of attorney, certificates, and arguments shall be submitted to the Board of Insurance Inspection; moreover, proofs shall be furnished that the Company has in a certain prescribed mode deposited with the Riksbank (the Bank of Sweden) an amount of 100 000 kronor for life, fire and maritime insurance, and of 50 000 kronor for every other kind of insurance. After the examination of the documents submitted, the inspection authorities will, if approved, grant the concession demanded. The business will then be subject to the control of the board of inspectors for insurance and to a certain degree of publicity, besides which there are provisions aiming at safeguarding the rights of policy-holders, in case the Company should cease to carry on business in Sweden.

Both Acts contain provisions as to fines for various kinds of infractions of the law. The need of a modified and perfected insurance law is now universally admitted. In the first place, since the issue of the Act 1903, there has been passed a new Companies Act which entails corresponding changes in the Insurance Act; and in the second place modified views particularly in the sphere of life insurance, and with regard to the estimation of the insurance fund and the safety fund, have gradually engendered a powerful current of opinion in favour of an amended law, even though views on this point have not yet assumed definitive shape. Some essential modifications in the Act of 1903 were made by the Riksdag in 1914. The most important change in the law concerns regulations regarding the premium reserve, which was formerly computed solely on the basis of a certain death rate and a certain rate of in-

terest. According to the modified law an *estimate of expenditure* shall also be included in the principles for the computation of the premium reserve.

Maritime Insurance. In its preamble, the Maritime Law of 1667 expressly mentions among the "useful discoveries" that have rendered the new law necessary, "bottomries and insurances", and the actual text of the law contains an insurance section, divided into eighteen short chapters.

When that Act was issued, however, Sweden did not possess any insurance companies of native origin, with the possible exception of a few stray "private companies" *(enkla bolag)*, in the shape of more or less permanent associations of private maritime insurers, who through the agency of ship-brokers took over maritime risks. Swedish ship-owners and merchants were in most cases obliged, for maritime insurance, to have recourse to private insurance companies of a similar kind *abroad* — doubtless mostly in the Netherlands and in the Hansa cities of northern Germany; according to an estimate in *O. v. Dalin's* "Argus" published in 1733, the maritime insurance premiums dredged the country annually of 1 million Dutch guldens. But by the Royal Ordinance of the 4th July 1739, in response to a petition presented by the Estate of the Burghers, a charter was granted and "rules of association" were authorized for a company based on voluntarily subscribed stocks and limited liability, designated the **sjöassuranskompaniet,** the Maritime Assurance Society; it began its operations in the following year, and was thus one of the earliest insurance companies in Europe in the maritime insurance line. The second Swedish company of the same nature, the *Stockholms Sjöasssurans Sällskap*, the Stockholm Maritime Assurance Society, did not receive its charter till 1816. In 1844 was formed the first large mutual insurance company in this line of insurance, notably the *Stockholms Sjöassuransförening*, the Stockholm Maritime Insurance Union, which however, like the two companies previously mentioned, has now passed out of existence.

The very considerable development that native insurance business has now attained in Sweden — for considerable it is for Swedish conditions — does not date further back than the sixties and the seventies, when several *joint-stock companies* based on entirely modern principles were brought into being. At the termination of 1912 there were 10 of these companies in operation: the Gauthiod (chartered in 1863), the Stockholm Sjöförsäkringsaktiebolag (1867), Ägir (1872), Ocean (1872), Sveriges Allmänna Sjöförsäkringsaktiebolag (1872), Vega (1882), Sjöassuranskompaniet (1889), Öresund (1890), Hansa (1905), and Nordisk Yachtassurans (1905). In the same year 30 *mutual Swedish companies* were in operation, among which the *Sveriges Ångfartygsassuransförening*, the Swedish Steamship Insurance Union, is the most considerable. In Sweden the speculative business enterprises play a far more important rôle in maritime insurance than the mutual institutions, which, as a general rule, is also the case abroad. Besides the Swedish institutions, there were operating in this branch of insurance in Sweden in 1912 also 9 *foreign companies:* a few of which also give insurance on values. The business transacted by the said companies in 1912 aggregated the following amounts in kronor:

Companies	Insurances taken		Gross premiums	Premiums for re-insurance	Compensations	
	gross	reinsurance			gross	by reinsurers
Swedish joint-stock-companies	2 116 081 396	870 655 536	17 202 454	8 348 081	15 019 810	8 164 162
Swedish mutual companies	174 873 600	78 056 158	7 077 636	2 753 558	5 091 141	2 237 799
Total	2 290 954 996	948 691 694	24 280 090	11 101 639	20 110 951	10 401 961
Foreign companies .	66 242 193	——	203 487	112 993	102 780	62 975
Total	**2 357 197 189**	**948 691 694**	**24 483 577**	**11 214 632**	**20 213 731**	**10 464 936**

Registration and insurance of letters and other postal packets is the only form of insurance that has hitherto been transacted by the *State*.

Fire Insurance. The regulations of the Swedish *landskapslagar* (Shire Laws) of the 13th and 14th centuries, which obliged the inhabitants of the same *härad* (hundred) to mutual support in the event of damage by fire were doubtless founded on a very ancient practice. These regulations were afterwards, with certain modifications, introduced into the general laws affecting the whole of Sweden, and may be designated as legal provisions for obligatory mutual fire insurance; especially since it had been enacted in "*Huses Ordningen*" of 1681 — that the amount of the fire indemnity *(brandstod)* should be determined "according to the damage that had accrued". The indemnity prescribed by the law applied, however, at first only to buildings; from the end of the sixties of the seventeenth century it was extended also to corn, fodder and cattle, but only to "what was required thereof for the needs of the farm": it did not apply to other movables and household utensils. It was not till the nineteenth century that the compulsory *härad* fire insurance was transformed into small mutual fire indemnity companies *(brandstodsbolag)* based on voluntary principles, and retaining the right to have the indemnity fees collected along with the taxes to the Crown. But as early as 1688 was formed the first Swedish fire insurance society, intended for persons from at least one län and comprising also the insurance of goods and cattles.

The first fire insurance institution in Stockholm — the *Stockholms Stads Brandförsäkringskontor* (the City of Stockholm Fire Insurance Office), a kind of corporate but independent mutual society — had its first statutes sanctioned on the 18th March 1746. The oldest fire insurance joint stock company in Sweden is *Skandia*, which is likewise the oldest of the Swedish life insurance companies; its first articles of association received Government sanction on the 12th January 1855. In 1912 there were operating besides Skandia two Swedish joint stock insurance companies, notably *Svea* (Gothenburg: since 1866) and *Skåne* (since 1884), which transact both fire and life insurance business, one, *Fenix* (1889), which carries on solely Fire Insurance, two, *Norrland* (1890) and *Victoria* (1899), which, besides fire insurance business, transacts also burglary and glass insurance; Norrland also transacts travellers' luggage and fidelity

guarantee insurance, and Victoria insurance on damage by water. In the same year 15 mutual companies with a wider radius of operations than one län were at work, of which 7 embraced the *whole of Sweden,* among them the Städernas Allmänna Brandstodsbolag (the Cities' General Fire Indemnity Company), and Allmänna Brandförsäkringsverket för byggnader å landet (The General Fire Insurance Office for Buildings in the Country), *6 more than one län,* among them the Skånska Brandförsäkringsinrättningen (the Scanian Fire Insurance Institution), *2 only the City of Stockholm,* notably the Stockholms Stads Brandförsäkringskontor (the City of Stockholm Fire Insurance Office) established 1746, and the Stockholms Stads Brandstodsbolag till Försäkring av Lösegendom (the City of Stockholm Fire Indemnity Company for the Insurance of Movable Property, established 1844). There were 23 Swedish mutual companies each embracing in its sphere of operations *one län,* and not less than 368 *smaller* mutual companies. To this fall to be added Swedish general agencies for 26 foreign companies, out of which 3 were Danish, 1 Finnish, 6 German, 1 Swiss, 12 English, 2 French, and 1 Dutch. All, expect the German and the Swiss, were members of the Swedish Joint-stock Companies Tariff Union (Svenska Aktiebolagens Tarifförening), established in 1874. That Union has powers to pass resolutions binding on its members as to the amount of the premiums they are entitled to take for various kinds of risks, and with regard to other matters where it is essential that a uniform procedure should be adopted by all the companies belonging to the Union.

The turnover of all these fire insurance institutions in the course of the last years for which statements have been published,[1] is shown, reckoned in millions of kronor, by the following summary:

Companies	Gross premiums	Premiums for re-insurance	Compensations gross	Compensations by re-insurers	Insurances held at end of year gross	Insurances held at end of year re-insured
Swedish joint stock companies . .	26·61	11·54	16·74	7·58	7 850·21	3 460·04
Large Swedish mutual companies .	4·25	0·89	2·15	0·68	2 804·58	457·43
"County" (län) mutual companies .	2·28	—	1·49	—	2 442·29	—
Small mutual companies.	2·37	—	1·58	—	1 891·90	—
Total Swedish companies	35·51	12·43	21·96	8·26	14 988·98	3 917·47
Foreign companies	3·05	1·87	2·53	1·67	823·30	468·21
Total	38·56	4·30	24·49	9·93	15 812·28	4 385·6

The gross insurance sum thus amounted at the close of 1912 to 15 812·28 million kronor. It should be noted, however, that most Swedish joint stock companies also carry on important business in *foreign countries.* Thus at the termination of 1912 these foreign insurances represented a gross value of not less than 2 888 million kronor, out of which 812 million kronor

[1] The figures refer, as regards Swedish joint stock companies and foreign companies to the calendar year 1912, and as regards Swedish mutual companies as a rule to the financial year terminated within the period from the 1st July 1912 to the 30th June 1913.

were reinsured; the takings in the form of premiums for these insurances were 15·8 million kronor, and the compensations paid out totalled 10·6 million kronor. The gross value of the Swedish insurances should thus aggregate over 12·9 milliards of kronor; in order then to find the net amount of fire insurance for Sweden, one must, of course, deduct from the gross total the amounts reinsured in Swedish companies or in the Swedish general agencies of foreign companies, and add to it any insurances taken direct from the Company abroad and not reinsured in Sweden. How the gross insurance sum is distributed between real and movable property is not clearly shown by the figures.

Life insurance — at any rate in the form of funeral benefits — as well as several other kinds of personal insurance, was practised by the ancient guilds, though in more or less rudimentary forms. But modern life insurance based on scientific principles was first introduced into Sweden by the *Skandia* Fire and Life Insurance Company (1855), which was next succeeded by *Svea* (1867). The first Swedish joint-stock-company with solely life insurance (in a wide sense: life, life annuity, and capital insurance) was *Nordstjernan* (1872). Next came *Thule* (1873), which by the principles on which it was constituted afforded a transition to the mutual companies, *Victoria* (1883) and *Norrland* (1890); *Skåne* (1884) also transacts fire insurance business, while, on the other hand, *Nordpolen* (1897) is only a life insurance company.

Besides this, there were 14 *mutual companies* (most of them with gua-

TABLE 141. *The Life Insurance Business of the Swedish Companies.*

Annually	Premiums[1] kronor	Compensations paid[1] kronor	Insurance funds at end of period kronor	Amount of life-insurance at end of period[2] kronor	Amount of life insurance per-head of pop. kronor
1855	33 833	—	33 483	1 382 300	0·38
1856—60	233 820	66 399	552 508	10 069 997	2·61
1861—65	334 859	121 115	1 203 892	12 531 002	3·05
1866—70	595 743	201 797	2 244 220	23 486 931	5·63
1871—75	1 508 940	369 559	6 240 578	58 948 152	13·45
1876—80	2 559 708	843 014	12 224 764	84 377 828	18·48
1881—85	4 433 236	1 455 629	23 768 849	155 677 025	33·24
1886—90	7 668 032	2 432 461	44 333 121	259 860 821	54·31
1891—95	10 829 806	3 940 730	73 567 205	360 479 566	73·28
1896—00	15 875 476	5 852 263	118 231 719	598 855 440	116·59
1901—05	22 627 589	8 588 878	180 117 387	883 306 873	166·82
1906—10	31 140 224	13 419 529	268 700 458	1 239 396 628	224·45
1911—12	39 505 031	16 582 338	326 671 254	1 461 050 841	260·71

[1] The figures for the insurance amounts refer only to actual life insurances: the other figures, on the other hand comprise also life annuity and capital insurances, and the like. The figures up to 1895, inclusive, show net amounts; and are the same as in the previous edition of this work. The figures from 1896, inclusive, correspond to the official figures in the publication "Meddelanden angående försäkringsväsendet i riket, 3", and show net amounts. — [2] In the case of one company it has been possible to reckon these net amounts only approximately for the periods from 1866 to 1885.

ranteed capital, which is to be gradually replaced by accumulated profits), namely

The Allmänna Lifförsäkringsbolaget (from 1887), Balder (1887), Oden (1889), Svenska Lifförsäkringsbolaget (1891), Svenska Arbetarförsäkringsbolaget Valand (1895), Nordiska Folkförsäkringsaktiebolaget Union (1895; at the beginning of 1900 amalgamated with Valand), Svecia (1898), Lif- och sjukförsäkringsaktiebolaget Vasa (1898), Allmänna Pensionsförsäkringsbolaget (1898), Vanadis (1899: dissolved in 1901) and Svenska Arbetarförsäkringsanstalten Trygg (1899). Then came Brage (1900), Nornan (1900, the latter also amalgamated with Valand), Kronan (1902; dissolved in 1913), Stockholm (1906), Kristna Vänner (1911) and Framtiden (1911). To these fall to be added 21 agencies for foreign companies. The business transacted by the companies in 1912 and the balance at the close of the year is shown by the following summary, in million of kronor.

Companies	Gross premiums	Premiums for reinsurance	Compensations paid gross	Compensations paid by reinsurers	Insurance funds at the end of the year	Insurances held at the end of the year gross amount	Insurances held at the end of the year reinsured
Swedish joint-stock companies .	26·69	5·07	13·72	1·64	228·88	862·92	155·61
Swedish mutual companies . .	19·64	1·75	4·84	0·34	97·79	598·13	90·15
Total Swedish companies	46·33	6·82	18·56	1·98	326·27	1 461·05	245·76
Foreign companies	1·65	—	[1] 0·80	—	—	50·47	—
Total	**47·98**	**6·82**	**19·36**	**1·98**	**326·27**	**1 511·52**	**245·76**

[1] The figures are only for compensations paid at death.

The life insurances held at the close of 1912 numbered 1 322 293, out of which 817 830 were with the Swedish joint-stock companies, 488 063 with the mutual companies, and 16 400 with foreign companies. To this must be added altogether 6 359 annuities, to a total annual amount of 2 700 839 kronor, and 1 019 capital insurances, aggregating 2 451 882 kronor.

The funds appropriated to dividends and bonuses by the Swedish companies during the same year amounted to 3 373 508 kronor; the cash dividends to policy-holders for the year to 2 534 957 kronor.

The most common of the *forms of life insurance* are ordinary life insurance, with the payment of premiums during the whole period of life or only during certain years, and endowment insurance, in which the insurance sum is paid at a certain age (as a rule 55 or 60), or previously in the event of death. Since the early nineties children's insurances are also undertaken: in these children's insurances the actual liability of the insurance company does not come into effect until the age of 15 has been attained, although the payment of the premiums begins in the usual manner on the insurance being taken. Among other forms of insurance may be mentioned insurance with a fixed term of payment (à terme fixe), widows' pension insurance, survivors' annuity insurance, equipment insurances of divers kinds, short term insurance, insurance on two lives, and divers

other combinations. Insurances of these kinds can as a rule be obtained with or without medical examination. In the latter case the companies safeguard themselves against the risks of bad selection by a restriction of the company's liability during a certain term (*"karens"*). The Swedish term for insurance of this latter kind is *"karensförsäkring"*.

Vigorous efforts have been made during recent years to extend the benefits of insurance to the lower classes, both by the older companies in which the average insurance sum per policy-holder has in consequence shown a certain tendency to diminish, and also by certain institutions that have made it their special business to grant what is termed *"folkförsäkring"* (industrial insurance), modelled on similar institutions abroad.

In 1906 was formed the *Svenska lifförsäkringsbolagens direktörsförening* (the Swedish Life Insurance Companies Directors' Association), which, embracing as it now does practically all the Swedish life insurance companies, forms a rallying-point for deliberations on the common interests of the companies.

As regards the extent to which life insurance occurs, whether alone or along with other forms of personal insurance, in numerous funds and societies of divers kinds, large and small, the reader is referred to the section Social Movements (p. I. 631).

The 14 public *interest and capital insurance institutions (ränte- och kapitalförsäkringsanstalter)* and that belonging to the "Civil Service" *(Civilstaten)* paid out in 1912 in annuities a total of 892 135 kronor, in accumulated capital 558 770 kronor, and in inheritance and annuity benefits 669 627 kronor; the funds administered in these institutions amounted in the same year to 64 362 727 kronor.

Accident Insurance was carried on in Sweden, as in other Scandinavian countries, prior to 1881 only by foreign companies, and on quite a minor scale. In 1881, however, the *Fylgia* Company was formed, and several other accident insurance companies were successively founded. Besides Fylgia, the following joint-stock companies carried on accident insurance in Sweden in 1911: Skandinavien (since 1886), Norden (1888), Heimdall

TABLE 142. *Business transacted by the Accidence Insurance Companies.* Gross.

Annually	Average per annum, during the period, of		Number of persons insured at the end of the period			Total
	premiums	compensations paid	privately	collectively, irrespective of the Act of 1901	legally insured	
1882—85	229 857	96 439	12 988	3 718	—	**16 706**
1886—90	617 642	331 979	38 337	54 138	—	**92 475**
1891—95	1 086 093	699 540	37 067	77 395	—	**114 462**
1896—00	1 508 594	931 472	48 247	133 655	—	**181 902**
1901—05	2 475 082	1 444 806	46 920	63 876	183 021	**293 817**
1906—10	3 638 715	2 269 023	71 666	85 361	158 661	**315 688**
1911	4 011 996	2 469 277	73 774	90 141	157 839	**321 754**
1912	4 221 953	2 657 691	77 869	93 076	157 244	**328 189**
1913	4 257 837	2 806 841	79 016	92 696	158 902	**330 614**

(1900), Hansa (1905), and the *mutual companies* Bore (1888), Dalarna (1889) and Gothia (1898). In addition to these, a number of foreign companies carried on accident insurance in Sweden on a comparatively small scale. The amount of the business done by the Swedish companies since 1881 is shown by Table 142.

In the year 1903 the Workmen's Compensation Act of the 5th July 1901, providing for compensation for damage in case of accident, entered into force, and concurrently the *Riksförsäkringsanstalten*, the State Insurance Office, whose function is to take over the liability of employers under the act, began its operations.

After the beginning of the twentieth century the accident insurance companies have gradually expanded the scope of their activities, so as to embrace a number of other branches of insurance, such as, for instance, illness, liability, fidelity guarantee, burglary, travellers' luggage, glass, and damage by water insurance.

A few figures (million kronor) are subjoined showing the business done by the State Insurance Office and by the private companies in 1913:

Insurance institutions	Premiums[1]	Premiums for re-insurances	Compensations paid gross	Compensations paid by re-insurers	Number at end of year of insured persons	Number at end of year of persons insured under the Act of 1901
The State Insurance Office	0·78	—	0·58	—	115 120	114 822
Swedish companies	2·92	0·38	1·95	0·46	153 279	60 324
Swedish mutual companies	1·33	0·05	0·83	0·03	177 335	98 578
Employers' associations	.	.	.	.	23 082	23 082
Total	5·03	0·43	3·36	0·49	468 816	296 806
Foreign countries	0·68	.	0·25	.	24 148	11 102
Total	5·71		3·61		492 964	307 908

[1] The figures, as regards the State Insurance Office, give the net premiums; as regards the private institutions, their tariff premiums.

As to the other branches of insurance represented in Sweden, it is proposed here only to give a few figures. According to the report of the insurance inspector for 1912 there were engaged in cattle insurance 732 mutual companies and societies, among which 12 embracing the whole of Sweden, or larger or smaller parts thereof, and 720 with smaller spheres of operations as for instance, within the radius of a län, one or more "härad" districts, one or more parishes.

According to the data that have been forthcoming (not quite complete) there were insured at the close of the financial year 1911 354 756 horses and 390 725 head of cattle for 135 140 428 kronor and for 92 817 443 kronor respectively, and in the course of the same year damage had been compensated in the case of 10 466 horses and 2 920 head of cattle at 2 925 055 and 325 657 kronor respectively.

Damage by Hail Insurance was granted in 1912 by one damage by hail insurance society embracing the whole country, namely Allmänna Hagelskadeförsäkrings aktiebolaget, mutual; and by 7 likewise mutual "County" (*län*) com-

panies (the companies belonging to the läns of Uppsala, Östergötland, Skåne and Halland, Älvsborg, Skaraborg, Örebro and Västmanland). Besides these, the mutual fire insurance societies of Kronoberg län and of the rural parishes of Markaryd, Hinneryd, Tolg, Virestad, and Växjö also granted compensation for damage by hail occuring to crops insured against fire in the companies. Out of these companies, the Allmänna Hagelskadeförsäkringsbolaget had in the same year 5 357 shareholders with an aggregate insurance sum of 20 912 740 kronor, and the 7 län companies together 19 274 shareholders and 54 064 271 kronor in amount of liability; thus in 1912 24 631 properties were insured against hail to an aggregate amount of 74 917 011 kronor. In the course of the year 821 cases of damage by hail was compensated for with altogether 232 474 kronor, out of which 48 411 kronor was paid by the Allmänna Hagelskadeförsäkringsbolaget.

Burglary Insurance is given on personal movable property, goods, machines, inventories, and money, and on damage to buildings. These companies that give burglary insurance also give insurance against *highway robbery*. Insurance of this kind was carried on in 1912 by 11 Swedish joint-stock companies, namely Securitas, Skandinavien, Hansa, Norrland, Freja, Heimdall, Victoria (fire), Fylgia, Norden, Mercurius and Malmö, besides which one foreign company took up burglary insurance in Sweden.

The premiums for all these companies amounted in 1912 to about 505 000 kronor.

Travellers' Luggage Insurance, which is undertaken by the majority of the companies enumerated above, has not attained any great amplitude, as many of the risks coming under this head are doubtless covered by maritime insurance companies.

Glass Insurance, was given in 1912 by 12 insurance companies. Out of these 10 were Swedish, notably the Göteborgs fönsterförsäkringssällskap (the Gothenburg Window Insurance Company), the Svenska Glasförsäkringsaktiebolaget, Securitas, Stella, Skandinavien, Hansa, Fylgia, Norrland, Victoria (fire) and Malmö and 2 foreign companies. All these companies were liable at the termination of 1912 for an aggregate insurance sum of approximately 8 million kronor, as against a premium revenue of about 185 000 kronor. The damages in this year amounted to about 212 683 kronor gross.

Fidelity Guarantee Insurance, granted principally as a security against embezzlement by collectors of taxes and debts was transacted in 1912 by the three joint-stock companies, Hansa, Norrland, and Securitas, wich at the end of the year were collectively liable for 9 992 246 kronor, had a premium revenue of 93 448 kronor, and paid compensations to the amount of 82 103 kronor.

Liability Insurance, by which is meant insurance for the liability for damages, was granted in 1912 by four Swedish joint-stock companies, Securitas, Hansa, Heimdall and Skandinavien. The aggregate insurance stock amounted at the close of the year 1912 to about 30 mill. kr., the premiums to 52 275 kronor, and the compensations for damages to about 6 600 kronor. Besides there are 5 foreign companies wich carry on this business in Sweden.

Damage by water Insurance, for damage by water in the strict sense, was granted in 1912 by the six Swedish joint-stock companies, Securitas, Norden, Freja, Skandinavien, Victoria and Malmö and one foreign company, the total amount of the liability for all these companies together amounted to about 49 million kronor, the premiums to about 74 000 kronor, and compensations for damage to about 11 500 kronor.

In the sphere of **Sickness Insurance** there were operating in 1912 a number of companies. This kind of insurance has during the last decennium undergone a remarkable development. It has been carried on principally on two

main lines: sickness insurance subject to notice, and sickness insurance not subject to notice.

Sickness insurance subject to notice, mainly in combination with accident insurance was granted by the accident insurance companies, Fylgia, Skandinavien, Norden, Heimdall, Hansa, Securitas, and Gothia, as well as by a couple of foreign companies.

Sickness insurance not subject to notice was granted by the Eir Sickness Insurance Company.[1] That Company undertook on its own account sickness insurance solely, though, in addition to that, sickness insurance combined with life insurance in any one of the following companies: Skandia, Svea, Thule, Skåne, Allmänna Lifförsäkringsbolaget, Oden, Brage, or De Förenade.

Combined life and sickness insurance was transacted also by the Svenska Lifförsäkringsbolaget and by the Lif- and Sjukförsäkringsbolaget Vasa.

Besides the federations named above, notably the Tarifföreningen and the Svenska Lifförsäkringsbolagens Direktörsförening, the following societies are engaged in promoting the development of Swedish life insurance business: the Försäkringsföreningen (the Insurance Society) since 1875, and the Svenska Lifförsäkringsbolagens öfverläkareförening (The Swedish Life Insurance Companies' Medical Union) and the Aktuarieföreningen (Society of Actuaries).

The Försäkringsföreningen has its own press organ, namely the "Försäkringsföreningens Tidskrift", which has been issued since 1878. Other press organs in the insurance branch are the "Gjallarhornet" and the "Assurans".

[1] The Valkyrian Insurance Company on the 1st October 1912 started sicknes insurance business on essentially the same lines as the Eir Sickness Insurance Company.

XII.

SYNOPSIS OF TRADE AND INDUSTRIAL LEGISLATION.

Industry and trade, which from ancient times had been confined to the cities, and hedged in with oppressive restrictions, were liberated from their trammels in the middle of the nineteenth century by the abolition of the guild-system *(skråväsen)*, which took place in 1846. The principle of the liberty of trade is fully recognized in the Act of 1864, the Act which still governs trade legislation.

General Trade Legislation Regulations.

In order to acquire the *right of carrying on manufacturing business, handicraft, or other trade*, all that is required in the case of Swedish subjects is the enjoyment of civil rights and full legal majority: no certificate of professional skill or any other qualifications are demanded. Nor is any kind of special license required: all that is necessary is to give due notice of one's intention to carry on a trade.

But even there requirements may in certain cases be dispensed with. Industries or trades in which the sale of the goods made is not contemplated, or which are carried on without paid assistants, fall beyond the pale of the rule. Thus anyone is then and there at liberty to make articles of household use and moreover to carry on manufacture, handicraft, or other trade with the intent to sell the goods, provided that the trade be carried on without the assistance of others than wife and children.

Similarly farmers and the agricultural population generally are then and there at liberty to pursue any kind of domestic industry *(husflit)* with intent to sell the goods made, provided that they do so without the assistance of others than their wives, children, and servants.

If, on the other hand, the manufacture or handicraft goes beyond the range of a home industry, that is, if it is carried on with the aid of other

assistants than those mentioned, the regulations as to civil rights, legal majority, (attested by certificate), and notice of intention to carry on a business, come into force just as in the case of ordinary trade. In cases where the business to be is conducted in the name of a firm, the firm name has also to be registered. Notice is filed with the same Authorities as in the case of trade in the strict sense; the only exception being that for any such business as a blast furnace, a foundry, a forge, iron works, or other establishments intended for the utilization or refinement of the products of the mineral kingdom, and not in the nature of a handicraft, notice shall be given to the Board of Trade.

The business of a manufacturer or trader may be continued on behalf of his heirs for a year after his death.

Obviously, the qualifications which the law does exact from a manufacturer or trader are exacted in the interest of his customers or of his assistants: the object of the registration is to ensure that a manufacturer or trader does actually possess the required qualifications; it also serves as a basis for taxation and statistical returns. Finally, it is useful for purposes of Government supervision especially with regard to the mode in which assistants are employed.

Special Regulations for certain Occupations.

There are certain occupations which are subject to *more stringent regulations*, bottoming in the solicitude of the State for the lives, the health, and the property of her citizens, or proceeding from the necessity for some other form of Government supervision.

Thus the State requires that anyone desirous of running a factory in which chemical processes are employed, and where a mistake might entail danger of fire or imperil life or health, shall produce evidence of his possessing the necessary *technical skill*. No one is entitled to run a factory of the kind contemplated, without showing to satisfaction that he either possesses personally the technical skill required, or that he has engaged a manager possessing the said skill. A certificate to this effect shall be annexed to the notice of registration.

These special regulations apply principally to the following categories: manufacture or refining of *inflammable oils* (Ordinance of 1875); manufacture of *explosives* (Ordinance of 1897); manufacture of *poisons* (Ordinance of 1906); preparation of *drugs* (Pharmacy Regulations of 1819, with supplementary statutes).

Further there are special regulations with regard to the manufacture of *margarine*, *margarine cheese*, as well as *artificial lard* (Ordinance of 1905); the manufacture of *brännvin* (spirits; Ordinance of 1907); and the manufacture of malt liquors; Ordinance of 1907). Whereas the manufacture of margarine and the like is supervised in order to prevent adulteration, the manufacture of *brännvin* is supervised for purpose of the excise duty.

In certain cases there are special regulations as to the erection of factory buildings. The Public Health Statute of 1874 imposes certain restrictions as regards the erection, the equipment, and the running of certain insanitary factories and other such establishments. Printing establishments shall be erected only in towns or large villages, or within a certain radius of distance from them (Press Law).

Certain other occupations are subjected to special restrictions, thus, for instance, chimney-sweeping in towns. Then again, chauffeurs and motor-cab owners require certificates of competence (Ordinance of 1906).

A special license is required for the exhibition of *kinematograph films* both in town and country, and all films have to pass censure, except those representing events of the day (Ordinance of 1911).

A special license is required for keeping a registry office for servants (Ordinance of 1884), or an emigrants agency (Ordinance of 1893).

The relations of manufacturers or traders to the workmen in their employ come under various Acts; thus, for instance the Liberty of Trade Ordinance, the Ordinance of 1896 providing for measures to prevent necrosis among workmen engaged in match factories, the Sale of Lucifer (Phosphorus) Matches Ordinance of 1900, the Protection of Workers Act of 1912, and so forth. For a more detailed account of legislation on this subject see the section Legislation for the Protection of Workers (p. I, 704).

Companies.

The Swedish Companies Acts distinguish between three different kinds of companies, namely *handelsbolag*, or partnership, *enkelt bolag*, or private company, and *aktiebolag*, or joint-stock company.

A **handelsbolag**, (literally: trading company) or partnership, is a company formed by two or more persons for the purpose of any kind of trade in which the keeping of merchant's books is obligatory (Law of 1895). The obligation to keep books devolves on all persons, companies, or societies, that carry on business, wholesale or retail, or manufacture goods with a view to profit (Ordinance of 1855; law of 1895). A *handelsbolag* is at Swedish law a legal *persona*, which as such, can acquire rights, incur liabilities, and enter into legal proceedings. The rights and liabilities of the partners during the life of the firm are determined by contract. Each of the partners is, as a rule, entitled to act on behalf of the firm. *Profit* and *loss* are distributed between the partners *pro rata*. If certain principles have been agreed upon for the distribution of profit solely or loss solely, they shall hold good in the distribution both of profit and of loss. Partner is not liable, at the instigation of his co-partners, to advance capital beyond the amount of his share. Apart from agreement, each of the partners binds the firm. *The members of a handelsbolag are jointly and severally liable for firm debts.* (Law of 1895.)

Besides the ordinary *handelsbolag*, which as will have been seen corresponds approximately to a partnership in England, the Swedish law recognizes *limited* partnerships, or partnerships in commandite (*kommanditbolag*). What constitutes a *kommanditbolag*, is that one or more (not all together) of its members have reserved themselves the right of *not being liable for more than he or they have invested, or have engaged to invest, in the company.* A firm of this kind shall contain the word "kommanditbolag". Unless otherwise agreed, a member of a kommanditbolag (which very nearly corresponds to a "sleeping partner in England") is not entitled to participate in the management of the business, and his acts do not bind the firm. (Law of 1895.)

Enkelt bolag, (literally: simple company) is the Swedish term for what in English would be called a *private company.* Should an *enkelt bolag* be registered, as sometimes happens, it is deemed to be a *handelsbolag.* An *enkelt*

bolag cannot, as a legal *persona*, acquire rights or incur liabilities, nor engage in legal proceedings.

The mutual rights and liabilities of the members during the existence of the firm are determined by contract. Apart from agreement, a member of the company cannot take action on behalf of the firm without the express consent of the other members. Profit and loss are distributed in the same manner as in the case of a *handelsbolag*. Contracts entered into in the name of the members of the firm, or under a designation jointly covering the members of the firm, do not affect a member of the firm *who has not taken part in the contract*. Where several members have taken part in the contract, their rights and liabilities are *pro rata*, unless otherwise agreed in entering into the contract. Where, in entering into a contract, the firm has been so styled as to imply a more unlimited liability, the members with whose consent the firm has been so styled are liable jointly and severally. If an *enkelt bolag* transact business with a view to commercial profit, the members of the company will in like manner be jointly an severally liable. (Law of 1895.)

An *aktiebolag* is almost the exact equivalent of an English **joint-stock company.** In an *aktiebolag* the members of the company are *not personally liable* for the engagements of the firm. In former times a company of this kind could not be formed except by a royal charter. The first Joint-Stock Companies Act was that of 1848. This Law was based on the charter principle: the powers and mode of management of the company were defined by charter. The Law of 1895, which entered into force two years later, introduced the *registration* system, under which persons desirous of forming a company are obliged to conform to certain regulations. It is the business of the registrar to see that the required formalities are complied with before registering the company. The company is incorporated as a joint-stock company as soon as registration has been made. The Law of 1895 was supplemented by that of the 12 August 1910 which extends the former.

The joint-stock company system has been largely developed in Sweden. Not only big enterprises, but a number of smaller undertakings of the most various kinds are jointstocked. The total number of joint-stocks companies in Sweden in 1908 was 4 919, with an aggregate capital of 2 034 228 000 kronor. The average amount of the share capital of these companies was 413 000 kronor. The following are the principal provisions of the Law of 1910. The funds invested are divided into shares (*aktier*) of equal size, and indivisible. Where the articles of association allow of variation in the amount of the capital, the minimum capital shall not be less than a third of the maximum. The share capital, or, in the case referred to, the minimum capital shall not be less than 5 000 kronor, and the nominal value of shares shall, as a matter of principle, not be less than 50 kronor. However, where the share capital does not exceed 50 000 kronor, shares may be issued for smaller amounts, though in no case less than 10 kronor. Shares shall be personal, but in certain cases Government may authorize the issue of shares to bearer.

Persons desirous of forming a joint-stock company shall subscribe a memorandum of association (*stiftelseurkund*), stating the general objects of the company. The memorandum of association is signed by the promoters of the company, who shall be at least five in number and all of them Swedish subjects domiciled in Sweden. The memorandum shall be published in the official Swedish gazette[1] and also in one of the local papers of the place where the Company is to have its registered office, two copies of the memorandum, and one copy of papers in which it has been inserted shall then be lodged with the proper authorities

[1] The "Post och Inrikes Tidningar".

(the Governors of the läns). The next step in the procedure is to draw up a subscription list for shareholders. A constitutent general meeting shall be held within a year from the filing of the memorandum with the authorities. The law contains special regulations providing for cases in which a promoter of the company or another is to receive indemnification for the formation of the company; cases which a promoter or another is to be empowered to pay his shares in some other form than money; similar cases in which the company is to be authorized to receive property, or in which one of its members is granted special privileges or rights. The constitutent general meeting resolves on the formation of the company, passes the *articles of association* (*bolagsordning*), and elects the board of directors. When this procedure has been duly gone through, the company is registrable, provided that at least half the share capital have been paid up.

It is incumbent on the board of directors to keep a transfer register (*aktiebok*), which must be accessible to public inspection. The accounts of the company shall be brought before the shareholders once a year, at the ordinary general meeting, to which the board of directors shall submit a report, accompanied by a balance sheet and a profit and loss account. These documents shall be filed with the Registration authority within a month after the balance sheet has been passed, and shall be kept open for public inspection. A company is represented by a board of directors, consisting of one or more Swedish subjects resident in Sweden. In special cases Government may grant that the board of directors shall consist in part, but not as to more than a third, of the subjects of another country, or of Swedish subjects resident abroad.

The ordinary rule is that the firm of the company is signed by the members of the board, one or more severally, or several jointly. The board of directors, however, can empower a person outside the board to sign the firm, if the articles of association so allow, or if the general meeting has authorized this exception from the rule.

The law also provides for the protection of the rights of minorities: for instance, in some cases, a minority is authorized to refuse discharge, to pass a vote of censure against the directors, and so forth.

There are separate enactments for *railway companies* (Law of 1911), for *insurance companies* (Law of 1903), for *banking companies*, (Law of 1911), and for certain joint-stock companies that carry on *loan business* (Law of 1911). All companies under these heads require to have their articles of association sanctioned by Government (see the Section dealing with Banking, Credit and Insurance).

The formation of societies tends steadily to increase in Sweden. The Law of 1911 relating to **societies formed for economic purposes** (*ekonomiska föreningar*) has placed legislation on this subject on a modern footing. The societies covered by the Law are cooperative societies, dairy associations, societies for providing suitable dwellings for the working classes (*bostadsföreningar*), and so forth. Societies formed for economic purposes, which carry on business for commercial profit shall not give credit to others than members of the society. This restriction, however, does not apply to societies whose sales to the general public consist principally of products of the labour of the members or of the society, nor societies formed with the object of purchasing and selling goods intended for agricultural purposes. Societies with economic objects shall be registered in order to be incorporated as societies. The number of members shall not be less than five; not only individual persons, but companies, societies, corporations, or other communities or institutions, may be members. A society is represented by a board of directors, consisting of one or more Swedish subjects resident in the country, unless an exception from the rule has been authorized by Govern-

ment. There are two kinds of "economic societies", namely, those in which the members are not liable for the engagements of the firm (in Swedish: förening *"utan personlig ansvarighet"*, abbreviated *"u. p. a."*), and those in which the members are liable for a limited amount (förening *"med begränsad personlig ansvarighet"*, abbreviated, "m. b. p. a."). Cf. also p. I, 695.

As to **other kinds of societies,** such as societies with ideal aims, and societies formed by those belonging to the same profession or trade for mutual benefit but with other aims than the "economic societies", they are not at present covered by legislation. The regulations which do apply to them in the Liberty of Trade Ordinance (Näringsfrihetsförordning §§ 13 and 14) are now obsolete. (Cf. p. I, 647.)

Registrations of Firms.

The Swedish law requires that the names of firms shall be registered. The register of firms, which is called *handelsregister,* is kept at Stockholm by the *Överståthållareämbetet,* the Office of the High Governor, in other towns by *Magistraten,* the Magistracy, and in the country by *Konungens befallningshavande,* the Governor of the Län.

All those, whether private persons or companies who desire to carry on trade or business, for which keeping of merchant's books is compulsory, are obliged to have their firm entered in the *handelsregister.* The following categories, however, are exempt from this rule: shipowners and shipping companies, who are subject to special regulations with regard to the registrations of their ships; joint-stock companies, and the various kind of banking companies which are filed in the central register of joint-stock companies; societies formed with economic objects, which, if they have to be registered at all, are filed in the local register of societies. Private companies may, in certain cases, be registered in the *handelsregister,* and are then deemed to be *handelsbolag* (partnerships).

Personal firms shall contain the surname of the proprietor, with or without the Christian name, and the firm name shall not contain anything which indicates that the firm is owned by a company or a society.

The firm of a *handelsbolag* (partnership) shall, where the names of all the members of the company are not contained in the firm, contain the name of one of them, with some addition indicating that there are several members.

Notice of registration shall be made in writing prior to businesss being commenced. (Laws of 1887 and 1895, Ordinance of 1887.)

The *register of joint-companies* (*aktiebolagsregister*) is kept by the Patents and Registration Office, and all joint-stock companies are obliged to file their firms in this register. Joint-stock companies whose articles of association must be submitted for Government sanction (banking, insurance, railway companies, etc.,) are registered as soon the required sanction has been obtained. Other companies are filed in the register immediately after the articles of association have been passed. Alterations in the constitution of the company shall be immediately submitted for registration. (Laws of 1903, 1910, 1911, Ordinances of 1903, 1911.)

The *register of societies* (*föreningsregister*) is kept by the Governor of the Län. (Law of 1911, and Ordinance of 1911.)

The statements entered in the register shall be published in the official gazette. The Patents Office issues annually a serial publication containing matter compiled from the register. (Ordinance of 1911.)

The proprietor of a firm entered in the *handelsregister* may empower another to act on his behalf and sign his firm by **procuration;** in this case the procura-

tion is registrable. Written procuration implies that the procurator is authorized to represent his principal before court of law or other authority, and to come to terms on his behalf. However, a procurator is not entitled to transfer away the real property of his principal or to permit it to be mortgages. Procuration conferring more limited powers than the above is not registrable.

Aliens.

As regards the right of *aliens* to carry on trade in Sweden, a certain amount of information may be culled from the above account. It is now proposed to gather up the law on the subject into a brief summary. The general rule is that the right of aliens to carry on trade, industry, handicraft, or other occupation with a view to commercial profit, is subject to the sanction of Government.

The procedure is as follows: An application is lodged with *Konungens Befallningshavande*, the Governor of the Län, accompanied by a certificate showing that the applicant is *myndig*, that is, of age and not under wardship, and that he possesses *god frejd*, a good character (this certificate is issued by the priest of the district in which one resides). Besides this, there must be a *borgen*, a guarantor's signature, or other security, for the due payment of rates and taxes during three years. The application must state the town or place in which the business is to be carried on. The Governor of the Län, having received these papers, may find it necessary to make further inquiries about the applicant and to demand explanations on certain points. He then forwards all the documents with his own comments to the State Department of Finance.

When the intention is to carry on any such business as a blast furnace, a foundry, a forge, an iron works, or other establishment intended for the utilization of refinement of the products of the mineral kingdom, and not in the nature of a handicraft, notice shall be given not to the Governor of the Län, but to *Kommerskollegium*, the Board of Trade (see above).

The license to carry on trade or other occupation for commercial profit includes the right to transport goods between places in Sweden and to and from places abroad. But the license does *not* include the right of peddling (*gårdfarihandel*), nor of assisting in peddling. Nor does the license include the right of *selling-off stock* (*realisation*), nor of assisting therein, without a special license from Government. The procedure is the same as in the case of an application for trading rights. On the other hand, no license is needed for an alien to hold a share in a ship (*reda i skepp*) but his share must not extend to more than a third of the tonnage of the vessel, and he shall not be the principal owner.

Not is a special license required for an alien to ship on board a Swedish vessel, subject, however, to the proviso, that in shipping on board a vessel in Sweden itself, the crew shall not consist more than as to one fourth of aliens. The master or mate shall not be an alien. During the herring season in Bohuslän, an alien who is desirous of purchasing fish for exportation, need only give notice to that effect to the *länsstyrelse* (län government), or to the *kronobetjänt* (country police officer), or to the *magistrat* (the Magistracy). This does not however involve the right to cure fish, except so far as that may be necessary for the preservation of the fish in transit.

An alien requires a Government license in order to become a member of the board of a Swedish joint-stock company or a registered society. An alien may not be a share-holder in a joint-stock banking company or in an unlimited

(*solidarisk*) banking company. There are moreover certain railway companies whose articles of association do not permit a foreigner to own shares in them.

Aliens are not entitled to give public entertainments or to take part in them without a license, for which application must be made to the police authorities. License is not granted for more than three months at a time. An indispensable condition for getting a license of this kind renewed is that the fee on account of the previous license shall have been paid.

There is nothing to prevent a foreigner acting as a procurator for a joint-stock company or a registered society.

The right for the vessels of alien nations to carry on cargo trade in Sweden is a matter of treaty.

It has been stated above that in certain cases the Swedish law requires a foreigner to furnish security for the due payment of his rates and taxes, for three years. When the three years period has expired, he will be obliged to have the security renewed for another period of three years, if he wishes to continue in the enjoyment of his license. The new security is, as before, lodged with the Governor of the Län.

During the days of the Union with Norway, *Norwegian subjects* were in important particulars, placed on the same footing as Swedish subjects. With the Dissolution of the Union in 1905, these privileges ceased to exist. However, the new regulations did not have retroactive effect, so that Norwegians who had already acquired property, trading rights, or other privileges in Sweden, are still allowed to continue in the enjoyment of those rights.

Weights and Measures.

The motley ancient Swedish system of weights and measures, for the reform of which a variety of proposals had been brought on the carpet ever since the days of Gustavus III, was reformed and unified in 1885, in strict accordance with the decimal system. However, the new measures which had scarcely come into complete operation before they were superseded by the adoption of the **metrical system,** which the Riksdag of 1876 carried through.

The metrical system became obligatory from 1889. However it has been adopted for medical purposes as early as 1869, and in the Post Office as early as 1873. The metrical system was used in the Customs and in the State Railways in 1881.

The present law as to weights and measures is the Ordinance of 1885. For commercial purposes no other instruments shall be used for measuring or weighing but those that have been tested **(justerade)** in Sweden. For the purpose of testing weights and measures, Sweden is divided into 53 *justeringsdistrikt,* or inspection districts, each superintended by an official called **justeringskontrollör,** assisted by subordinates called *justerare.* The supervisory board is the *Royal Mint and Assay Office,* which has the sole right of testing instruments of precision.

Sweden sends a deputy to the *International Bureau of Weights and Measures,* founded in 1875, which has its headquarters at Paris. The object of that institution is to furnish States who have adopted the metrical system with standard weights and measures, and to determine certain technical details in order to attain perfect uniformity.

Private Organizations.

In certain departments connected with this matter attempts have been made to supply, by means of private organizations, what is lacking in the provisions secured by legislation. Of great importance in this respect are the *Merchants' Associations* and the *Swedish Advocates' Union.*

The **Merchants' Associations**, of which the most important are the Stockholm Merchants' Association (founded in 1858) and the Gothenburg Merchants' Association (founded in 1857), are associations of wholesale merchants in the different places, formed with the object of protecting the members' interests in the matter of insolvent clients and of preventing or reducing the losses inseparable from the credit-system which prevails in the wholesale trade. With this purpose in view, the associations have organized a corps of reliable legal representatives in different places in the country, whose duties are partly to collect and communicate information about the traders in their respective districts, partly to enforce payment of debts and to conduct legal proceedings. The legal representatives are remunerated according to a fixed scale. In the case of a trader in a particular district suspending payment or being made bankrupt, the legal representative for that district is generally entrusted with the duty of winding up the estate of the debtor. A list of the legal representatives of the association is generally inserted in a periodically published calendar (e. g. The Commercial Calendar of Sweden). In 1907 the activities of the merchants' associations were considerably extented by the institution by the Stockholm, Gothenburg, and Malmö associations of so-called *Composition- and Bankruptcy departments.* Within these departments, bureaus have been set up, which, partly, by means of their officials, directly wind up the estate in the event of a trader in whom the members of the association are interested compounding with his creditors or being adjudged bankrupt, and partly examine and control the estate by means of inspectors. The departments co-operate with each other, but each one has a special district within which its activities are exercised. The composition and bankruptcy departments have proved to be of great service for wholesale trade. (Cf. p. I, 324.)

The **Swedish Advocates' Union** was formed in the year 1887 and is an association of the country's professional advocates. The union has a governing body in Stockholm, which conducts the affairs of the union, examines applications for membership, exercises disciplinary authority over the members of the union, and adjudicates in the case of disputes arising between advocates and their clients as to the remuneration for services rendered. The members of the union bind themselves to accept without appeal the awards made, when a client calls for such adjudication. At the end of the year 1914 and the beginning of the year 1915, the number of members amounted to 220, residing in 42 places; of these members, 101 were in Stockholm, 28 in Gothenburg, and 13 in Malmö. For the guidance of the public in the choice of a legal representative, the union publishes an annual list of its members, which is included in the Swedish State Calendar. (Cf. p. I, 318).

Patents.

In Sweden, as in several other countries, the origin of the patent system can be traced to the privileges, called *privilegia exclusiva,* which the Government in earlier times granted by way of reward and encouragement to a person who had either made some invention himself which could be advantageously employed in home manufacture, or had started some kind of trade which had hitherto not been carried on in Sweden.

At the Riksdag of 1809, a Bill was introduced for a better ordering of the system by which privileges for inventions were conferred, and on April 28, 1819, what was virtually the first Patents Law in Sweden was passed, although the Law still spoke of "*privilegia exclusiva*". For many reasons, the chief of which, perhaps, was the preliminary examination required by the Act as to the novelty and utility of the invention, this Ordinance soon aroused much dissatisfaction, and, after repeated representations from the Riksdag, a new Ordinance was promulgated on Dec. 13, 1834, in which the word "privilege" was exchanged for the modern term "patent". Under this Ordinance patents were to be conferred without a preliminary examination as to novelty. The Swedish Patents Ordinance of 1819, as well as that of 1834, contained a clause to the effect that, if no objection had been entered against a patent within a certain time after it had been granted, of patents, could not be contested. This enactment, which is also found in the German Patents Act of 1891, was excluded from the next Swedish Patents Act, issued on August 19, 1856.

As industrial activity in Sweden rapidly developed in the late sixties and early seventies of the last century, and inventors began to a greater extent to resort to the protection of patents the defects of the patents law of 1856 became more clearly apparent, and the demands on the part of industrial interest for a more effectual and more modern patent system grew increasingly insistent. After thorough preliminary investigations, proposals were at last drafted, which were accepted by the Riksdag of 1884, and received the Royal Assent on May 16, of the same year. This statute, which came into force on January 1, 1885, is the present Patents Act. It has since been amended in certain particulars so as to render the protection afforded by patents more effectual, and to facilitate the obtaining and maintenance of patents.

Patents are granted in Sweden for new inventions of industrial products or special methods for their production. If the invention relates to foods or drugs, protection cannot be obtained for the article itself, but only for a special process for manufacturing the same. Inventions which are contrary to law or morality are, however, excluded from protection. None but the inventor or his assignee are entitled to a patent.

Before a patent can be granted, the novelty of the invention is examined into by the **Royal Patents and Registration Office,** the documents of application being kept accessible for inspection by the public for two months, and it being open to any one during that time to oppose the grant of the patent.

The duration of a patent in Sweden is 15 years, reckoned from the date of application. As in most other countries, annual *fees* have to be paid on penalty of the patent becoming invalid. In Sweden, however, these fees are very moderate. 20 kronor are paid on filing the application, and afterwards 25 kronor a year up to and inclusive of the fifth following year, 50 kronor for each of the five years next succeeding, and finally 75 kronor for each of the remaining five years. Thus, the total sum required for maintaining the patent rights for the whole term of the patent amounts to 745 kronor. To be perfectly accurate, however, there is in addition to this a stamp fee of 10 kronor for the letters patent. The Patents Law of Sweden does not allow of any reduction of or dispensation from these fees.

The patentee is under obligation to work his invention in Sweden to an extent conformable to conditions prevailing in that country. If he neglects so to do, any person desirous of obtaining permission to work the invention in despite of the patent may bring an action against the patentee before the City Court of Stockholm, but not until the expiration of three years from the granting of the patent. If the Court is satisfied as to the justice of his claim, it grants such

TABLE 143. *Patent Applications filed in Sweden during 1885—1913.*

Classes of industry	The inventor domiciled		Total
	in Sweden	abroad	
Refrigerating devices	101	115	216
Baking industry	184	102	286
Clothing industry	182	230	412
Illumination	495	719	1 214
Bleaching, dying, calendering (of textile products)	281	378	659
Blowing machines and ventilators	41	136	177
Bookbinding and books	156	98	254
Brush and paintbrush manufacture	80	75	155
Fuel	331	268	599
Fireplace devices	291	562	853
Electrotechnics	1 067	2 735	3 802
Explosives and match industry	151	427	578
Fats and mineral oils	112	229	341
Plaiting and knitting	52	81	133
Photography	69	197	266
Colours and dyes, varnishes and other paints	126	202	328
Articles of Food	339	580	919
Tanning and currying	43	131	174
Gas making	215	453	668
Casting and moulding (of metals)	95	196	291
Glass industry	59	205	264
Mining and mining structures	87	115	202
Manures	90	93	183
Travelling utensils	149	116	265
Hat manufacture	45	32	77
Hygienics and sick nursing	292	446	738
Building industries	476	478	954
Instruments and measuring apparatus	616	704	1 320
Iron and steel manufacture	204	293	497
Railways and Tramways	465	951	1 416
Chemical apparatus and processes	362	1 240	1 602
Controlling and registring devices	187	265	452
Haberdashery	288	232	520
Milling industry	182	239	421
Agriculture, forestry, and gardening	2 849	1 083	3 932
Clay, brick and tile, cement and stone industries	334	670	1 004
Lifting devices	179	137	316
Locks, bolts, fittings	641	304	945
Ore concentration and refining	165	204	369
Machine Parts	1 222	1 036	2 258
Sundry materials	73	299	372
Metal work, chemical	29	133	162
Metal work, mechanical	661	1 112	1 773
Metal wire and metal-sheet manufacture	15	58	73
Metallurgy and smelting	379	717	1 096
Motors	694	709	1 403
Musical instruments	212	131	343
Furniture and domestic utensils	1 892	795	2 687
Paper articles and paper work	121	234	355
Paper and wood pulp manufacture	242	650	892
Presses	30	69	99
Pumps	199	197	396
Regulators for power engines	56	63	119
Rope making	11	25	36
Life saving and salvage	167	183	350
Saddlery, carriages, bicycles	825	1 046	1 871
Salesmanship	232	255	487
Harness and carriage gear	201	78	279
Signalling	177	223	400
Ship-building and navigation	404	616	1 020
Firearms, armour, ammunition	394	1 191	1 585
Boot and shoe manufacture	233	565	798
Writing and drawing materials	262	142	404
Cutting tools	106	68	174
Slaughtering and meat curing	45	56	101
Grinding and polishing	93	98	191
Sugar industry	60	233	293
Spinning and carding	45	141	186
Sports and athletics	355	284	639
Spinning fibres and their treatment	18	77	95
Sewing machines	64	181	245
Devices for tapping or bottling and retailing liquids	406	537	943
Tobacco industry	25	166	191
Drying apparatus	228	193	421
Transport	412	360	772
Printing and stamping	187	632	819
Wood working and refining	862	603	1 465
Heating devices	828	527	1 355
Watch making	80	80	160
Water works	40	88	128
Water closets and drainage	139	140	279
Water and wind motors	160	138	298
Tools	204	168	372
Textile industry	82	218	300

TABLE 143 (cont.) *Patent Applications filed in Sweden during 1885—1913.*

Classes of industry	The inventor domiciled		Total	Classes of industry	The inventor domiciled		Total
	in Sweden	abroad			in Sweden	abroad	
Construction of Roads	198	181	379	Brewing and distilling	87	255	342
Steam engines	331	512	843				
Steam boilers	228	482	710	Total	26 095	32 666	58 761

concession, with such restrictions and conditions and against such compensation as it deems to be fair and reasonable.

Thus, under this enactment, which was embodied in the Act of May 9, 1902, the patentee does not actually lose his patent by neglecting to work it, as was formerly the case in Sweden, and is still so in most other countries, but merely exposes himself to the risk of a compulsory license (tvångslicens) being ordered by the Court.

Legislation in Sweden has thus solved, and, as experience seems to show, happily solved the difficult question how, without prejudice to the interests of home industries, to enforce obligation of working a patent in such a manner that the obligation shall not be unnecessarily onerous to the patentee to fulfil, nor yet shall render the validity of the patent precarious.

When an action for a compulsory license is brought before the City Court of Stockholm, three experts on industrial questions besides the qualified number of judges shall sit and have a vote in the Court, these experts annually being nominated by the patent authorities.

We see here the germ of a *special court* for actions relating to industrial rights of property.

The Table 143 gives a summary of the number of patent applications filed at the Patents-Office, distributed over the various classes of industries.

It may be well to mention that Swedish legislation relating to commercial and industrial rights of property as a whole, that is not merely to patents but also to trade-marks, patterns, and models, is at present in process of revision by a Committee specially appointed by the Government. This Committee has also drafted a proposal for a reorganization of the Royal Patents and Registration Office, which reorganization was in the main accepted in the present year by the Government and Riksdag and will come into force at the beginning of the year 1915.

Another question which is the subject of investigation by the same Committee is that of what legislative measures can be adopted to obviate "unfair competition" *(illojal konkurrens)* and to prevent the false description of goods.

Trade-Marks.

After the gradual abolition of most of the ancient Guild statutes or ordinances relating to manufactures and crafts, and containing numerous provisions as to stamps and marks to be affixed to goods, manufacturers and tradesmen were allowed, by the Royal Proclamation of June 13, 1862, at their option, to affix

their own stamps or marks to their goods, and to advertize publicly the appearance and nature of those stamps or marks. However, the protection which a tradesman could expect for his trade-mark, on the ground of the Royal Proclamation of 1862 and of certain clauses in the Criminal Law, was very precarious, and according as trade expanded and the sphere of commercial operations was extended, the drawbacks of the inadequate protection afforded by trade-marks made themselves more and more acutely felt. To remedy these defects, a committee was appointed by the Government to draft new proposals for securing more effectual protection to trade-marks, but these proposals did not lead to any result, as in the meantime events had taken another turn. The fact was that, on the initiative of the Swedish Riksdag, the three Scandinavian kingdoms, Sweden, Norway, and Denmark, had entered into joint legislatory action, which had resulted in uniform bills-of-exchange laws being enacted for the three countries. It was now found desirable to pursue the same policy also with respect to trade-marks legislation, and, accordingly, a joint committee was appointed, which drew up proposals, uniform in all essential points, for trade-marks legislation for the three countries. After some slight amendments, the Swedish proposals were accepted by the Riksdag of 1884 and came into force on Jan. 1, 1885. This act, as amended by subsequent acts of March 5, 1897, June 16, 1905, and August 7, 1914, is still in force.

The right of property in a trade-mark, at Swedish law, is acquired by the *registration* of the mark. Everyone carrying on within the Kingdom manufacturing business, handicraft, agriculture, mining, trade, or any other form of commercial occupation, is entitled to acquire by registration the exclusive right to the use of a special trade-mark, to serve as a distinctive mark of his goods, in the open market. The registration need not be restricted to certain classes of goods. Trade-marks are non-registrable, in which the name of another person or another firm than that of the applicant, or the name of another person's real property is inserted, or which, unauthorized, contain public arms or stamps, or representations which might give rise to offence or which exactly immitate other marks already registered, or which so closely resemble such marks, though different in certain particulars, as to be calculated to deceive. A trade-mark is non-registrable which consists only of numerals, letters, or words which are not so distinguished by their peculiar form or shape that they can be considered a distinctive mark. However, if the word may be deemed to be a specially invented name for certain classes of goods and to have no reference to the origin of the articles in question, or their nature, use, quantity, or price, it is registrable as a trade-mark.

The registration fee is 40 kronor and the duration 10 years, renewable from time to time for a period of ten years on payment of a renewal fee of 10 kronor.

A foreign manufacturer is entitled to register and protect his trade-mark only insofar as he belongs to a foreign country which has entered into a special convention with Sweden in this regard. He is obliged, as in the case of a patent, to have resident within the country an agent authorized to accept responsibility on his behalf in all matters relating to his trade-mark, which, however, will not be protected to a greater extent, or for a longer term, than in the foreign country in question.

Gold and silver wares must bear the official stamp — three crowns. Moreover, the article must be furnished with the name of the manufacturer, the place of manufacture, and the date, before the hall-mark can be affixed. The supervision of hall-marking is vested in the Royal Mint, with which, since the year 1910, has been incorporated the Royal Assay Office, established as early as 1753. For further information see pp 462, 664.

In Sweden, the stamping of *iron and steel goods* is also compulsory. Every

works for the blowing of pig iron or works for the preparation of pig iron as wrought iron or steel, or for the preparation of steel, or for any other coarse iron manufacture, must have a registered stamp as prescribed by the Trade-Marks Act, with which its products are to be marked, and penalties are fixed for omission to stamp iron or steel goods, as well as for the use of marks belonging to other iron works.

Designs and Models.

The same committee whose preparatory investigations form the foundation of the present patents and trade-marks acts, was also commissioned by Government to draft a Bill for measures to secure adequate protection against the reproduction of designs and models. Whereas the question of new legislation for patents and trade-marks was satisfactorily settled as early as 1884, models and designs have, chiefly owing to the stout opposition of textile manufacturers, remained without legal protection down to Jan. 1, 1900, and the protection now afforded relates only to one branch of industry — *the metal industry.* That industry had repeatedly made urgent applications for the protection of designs and it was impossible to doubt its earnestness in the matter.

The Swedish law relating to designs applies only to so called *ornamental designs* and *ornamental models* and is based on the principle of a precedent examination as to novelty. The parties entitled to protection are inventors of designs or their assigns, and registration is granted both to Swedes and foreigners, irrespective of whether Swedes can claim a corresponding advantage abroad. If the applicant is not resident in the country, he must have a representative residing in the country authorized to accept responsibility on his behalf in all matters relating to his rights to protection. The duration is five years from the filing of the application, and the law does not make mention of any extension of the term. The fee for registration is 10 kronor, paid once and for all. The registration is public, and the general nature of the design must be stated in the application, which must also be accompanied by three copies of a representation of the design or model.

XIII.

SWEDEN
IN FOREIGN LITERATURE

A Short Bibliographical List of Books, mostly of recent date, concerning Sweden and written principally in English, French, or German. State papers, official congress proceedings and consular reports not being entered, with few exceptions, nor articles of cyclopædias and essays of periodicals. Also the very confined space has made necessary the omission of more than one work perhaps as valuable as other ones mentioned here. — As to Swedish books on the same matter refer to Svenskt boklexikon 1830—1865, utarb. av HJ. LINNSTRÖM. 1—2 Stockholm 1883—84; Svensk bokkatalog. 1 (1866-1875)—6 (1906-1910). Stockholm 1878—1913; other bibliographical sources see ALMQUIST, J. A., Sveriges bibliografiska litteratur. 1—3. Stockholm 1904—1912.

At last it ought to be mentioned that this bibliographical list is based chiefly upon the collections of the Royal National Library in Stockholm.

Index.

General Handbooks.

Country and People.

Geography.
Travels.

The Swedish People.
Archæology. — History. — Demography besides Language; Dictionaries. — National Characteristics including Customs and Manner of Living.

Constitution and Administration.
Constitution. — State Administration, including Official Statistics, State Finances, Consular Office, Prison System. — Municipal Administration. — Law. — Religion and Church.

Education and Mental Culture.
Education. — Sloyd. — Swedish Gymnastics. — Sport. — Public Collections and Institutions for Science and Art. — History of Literature. — The Fine Arts. — Music. — Science.

Social Movements, including Labour Questions, Women's Rights, Temperance Movement, Hygiene, etc.

Economy.

A General Survey.

Agriculture and Cattle-Breeding.

Mining Industry and Metal Production.

Manufacturing Industries.

Commerce, including Shipping.

Credit Establishments.

General Handbooks.

Sweden, its People and its Industry. Historical and statistical handbook ed. by *Gustav Sundbärg*. Stockholm 1904. XI, 1141 pp. 8vo.

La Suède, son peuple et son industrie. Exposé historique et statistique, publ. par ordre du gouvernement, réd. par *Gustav Sundbärg*. Stockholm 1900. IX, 437 + 528, XX pp. 8vo.

Schweden. Historisch-statistisches Handbuch, im Auftrage der Kgl. Regierung herausg. von *J. Guinchard*. 2. Aufl., deutsche Ausg. T. 1—2. Stockholm 1913. XXIII, 850 + XI, 807 pp. 8vo.

Country and People.

Geography.

Sweden ed. by The Swedish Touring Club. With 17 maps and 7 plans. 2d rev. ed. London 1906. LXIV, 238 pp. 8vo.
The Swed. Touring Club's Guides. 7.

Schweden, Reisehandbuch mit staatlicher Unterstützung herausg. vom Schwedischen Touristenverein. Mit 36 Kart. u. Plänen. 2:e, durchaus neu bearb. Aufl. [Mit Nachträge u. Berichtigungen. 1906]. Stockholm 1900. VIII, 416 + VIII pp. 8vo.
Svenska turistföreningens reschandböcker. 6.

Sweden. A Short Handbook on Sweden's History, Industries, Social Systems, Sport, Art, Scenery, etc. Ed. by The Swedish Tourist Traffic Society. Stockholm 1906. 178 pp., 10 pl., 1 map 8vo.

Schweden. Ein kurzer Führer durch Schwedens Geschichte, Wirtschaftsgebiete, soziale Verhältnisse, Unterrichtswesen, Sport, Kunst, Natur etc. Hrsg. von Verein zur Förderung des Fremdenverkehrs. Stockholm 1906. 163 pp., 10 pl., 1 map 8vo.

BÆDEKER, K., Norway, Sweden, and Denmark. Handbook for Travellers. 62 maps, 42 plans. [With Sketch of Grammar.] 10th ed. Leipzig 1912. LX, 478 + 38 pp. 8vo.

— Suède et Norvège, routes à travers le Danemark. Manuel du voyageur. 44 cartes, 26 plans. [Avec Petit manuel de conversation.] 4 éd. Leipzig & Paris 1911. LII, 535 + 44 pp. 8vo.

— Schweden, Norwegen nebst den Reiserouten durch Dänemark. Handbuch für Reisende. 62 Karten, 42 Plänen. [Mit Sprachlehre.] 12. Aufl. Leipzig 1911. LXVIII, 516 + 40 pp. 8vo.

STRINDBERG, A., Schwedische Natur. 3. Aufl. Berlin & Leipzig o. J. 110 pp., 1 pl. 8vo.

LAURIN, C., Sweden through the Artist's Eye. [Englished by *Grenville Grove*.] Stockholm 1911. 62 pp. 4to.

— La Suède vue par ses peintres. [Trad. par *F. Schulthess*.] Stockholm 1911. 64 pp. 4to.

— Schweden im Auge des Künstlers. [Übers. von *H. Buergel Goodwin*]. Stockholm 1911. 64 pp. 4to.

MAURY, L., Stockholm et Upsal. Illustr. de 128 gravures. Paris 1913. 148 pp. 8vo.
Les villes d'art célèbres.

KERP, H., Landeskunde von Skandinavien (Schweden, Norwegen und Dänemark). 11 Abbild., 1 Kart. Leipzig 1904. 138 pp. 8vo.
Sammlung Göschen.

HÖGBOM, A. G., Fennoskandia (Skandinavien und Finland). Heidelberg 1913. 197 pp., 1 pl. 8vo.
Handbuch der regionalen Geologie, hrsg. von *G. Steinmann & O. Wilckens*. Bd 4: Abt. 3.

Sveriges geologiska undersökning. Maps and Memoirs on Swedish Geology. A catalogue, publ. by the Geological Survey of Sweden. Stockholm 1910. 132 pp., 2 maps 8vo.

Travels.

BERTOLINI, G., L'anima del Nord. Studî e viaggî attraverso Norvegia, Svezia e Danimarca. Milano 1908. XVI, 442 pp. 8vo.

— Die Seele des Nordens. Studien und Reisen durch Norwegen, Schweden und Dänemark. Übertr. von *A. Mac Lean*. Mit 20 Abb. Berlin 1910. XII, 335 pp. 8vo.

DU CHAILLU, P., The Land of the Long Night. Illustr. London 1900. XVIII, 266 pp., 24 pl. 8vo.

— The Land of the Midnight Sun: summer and winter journeys through Sweden. With descriptions of the inner life of the people. Vol. 1—2. London 1881. 8vo.

— Le pays du soleil de minuit. Voyages d'été en Suède, en Norvège, en Laponie et dans la Finlande septentrionale. Paris 1882. IV, 503 pp., 1 pl. 8vo.

— Im Lande der Mitternachts-Sonne. Sommer- und Winterreisen. Frei übers. von *A. Helms*. Bd 1—2. Leipzig 1882. 8vo.

MARMIER, X., Lettres sur le Nord. Danemark—Suède—Norvège—Laponie—Spitzberg. 6 éd. Paris 1890. X, 479 pp. 8vo.

THOMAS, W. jun., Sweden and the Swedes. Illustr. Chicago & New York 1893. 749 pp., 1 map 8vo.

* * *

LAGERLÖF, S., The Wonderful Adventures of Nils. From the Swedish. Transl. by *V. S. Howard*. Illustr. [1—2]. London & New York 1908—11. 8vo.
2.] Further adventures of Nils. 1911.

— Le merveilleux voyage de Nils Holgersson à travers la Suède. Trad. par *T. Hammar*. Préface de *L. Maury*. Paris 1912. XVII, 408 pp. 8vo.

— Wunderbare Reise des kleinen Nils Holgersson mit den Wildgänsen. Übers. von *P. Klaiber*. Volksausg. Bd 1—2. München [1913]. 8vo.

The Swedish People.

Archæology.

NILSSON, S., The Primitive Inhabitants of Scandinavia. An essay on comparative ethnography. 3d ed., rev. by the author. Ed. and with an introduction by *J. Lubbock*. London 1868. LXXIX, 272 pp., XVI pl. 8vo.

— Les habitants primitifs de la Scandinavie. Essai d'éthnographie comparée, matériaux pour servir à l'histoire du développement de l'homme. P. 1. Paris 1868. XXIII, 323 pp., XVII pl. 8vo.
1. L'âge de la pierre. Trad. [par *J. H. Kramer*].

— Das Steinalter oder die Ureinwohner des scandinavischen Nordens. Ein Versuch in der comparativen Ethnographie übers. von *J. Mestorf*. Hamburg 1868. XXVII, 190 pp., XVI pl. 8vo.

NILSSON, S., Die Ureinwohner des scandinavischen Nordens. Ein Versuch in der comparativen Ethnographie. Übers. [von *J. Mestorf*]. 2., mit 2 Nachtr. verm. Ausg. 1 + Nachtrag 1—2. Hamburg 1865—66. 175 pp., 5 pl. + 128 pp. 8vo.
1. Das Bronzealter. 1866.

MONTELIUS, O., The Civilisation of Sweden in Heathen Times. Transl. by *F. H. Woods*. With map & 205 ill. London 1888. XVI, 214 pp., 1 map 8vo.

— Les temps préhistoriques en Suède et dans les autres pays scandinaves. Ouvrage trad. par *S. Reinach*. Paris 1895. VI, 352 pp., XX pl., 1 map 8vo.

— Kulturgeschichte Schwedens von den ältesten Zeiten bis zum 11. Jahrhundert nach Christus. Mit 540 Abb. Leipzig 1906. 336 pp. 8vo.

HILDEBRAND, H., Das heidnische Zeitalter in Schweden. Eine archæologisch-historische Studie. Übers. von *J. Mestorf*. Mit 44 Holzschnitten. Hamburg 873. XII, 228 pp., 1 map 8vo.

— The Industrial Arts of Scandinavia in the Pagan Time. With woodcuts. London 1883. VIII, 150 pp. 8vo.
South Kensington Museum Art Handbooks.

WIMMER, L., Die Runenschrift. Vom Verf. umgearb. und verm. Ausg. Übers. von *F. Holthausen*. Berlin 1887. XXIV, 392 pp., 3 pl. 8vo.

History.

BAIN, R. N., Scandinavia. A political history of Denmark, Norway and Sweden from 1513 to 1900. Cambridge 1905. VII, 460 pp., 5 maps 8vo.
Cambridge Historical Series.

STEFANSSON, J., Sweden and Denmark with Chapters on Finland and Iceland. London 1914. 8vo.
The Story of the Nations.

FRYXELL, A., The History of Sweden. Transl. [by *A. von Schoultz*]. Ed. by *M. Howitt*. Vol. 1—2. London 1844. 8vo.

— Erzählungen aus der schwedischen Geschichte. Übers. von *T. Homberg*. Th. 1—2. Stockholm & Leipzig 1843. 8vo.

GEIJER, E. G., The History of the Swedes. Transl. by *J. H. Turner*. Portion 1. London n. d. XVI, 348 pp. 8vo.
1. From the earliest period to the accession of Charles X.

— Histoire de Suède. Trad. par *J. F. de Lundblad*. Paris 1839. 538 pp., 1 map 8vo.
Collection d'histoires complètes de tous les États européens.

— Geschichte Schwedens. Aus der schwedischen Handschrift des Verf. übers. von *S. P. Leffler*. Bd 1—3 [—1654]. Hamburg 1832—36. 8vo.
Geschichte der europ. Staaten hrsg. von *A. H. L. Heeren* & *F. A. Ukert*. Lief. 7: 2, 9: 2. 12: 1. (Bd 4—6. *Carlson, F. F.*, Geschichte Schwedens. Bd 4—6. 1855—87. Bd 7. *Stavenow, L. V. A.*, Geschichte Schwedens 1718—1772. 1908.)

CARLSON, F. F., Geschichte Schwedens. Aus der schwedischen Handschrift des Verf. übers. von *J. E. Petersen*. Bd 4—6 [1654—1706]. Gotha 1855—87. 8vo.
Geschichte der europ. Staaten, hrsg. von *A. H. L. Heeren* u. *F. A. Ukert*. Lief. 29: 1, 36: 1, 48: 1. (Bd 1—3. *Geijer, E. G.*, Geschichte Schwedens. 1832—36. Bd 7. *Stavenow, L. V. A.*, Geschichte Schwedens 1718—1772. 1908.)

STAVENOW, L., Geschichte Schwedens 1718—1772. Deutsch von *C. Koch*. 7:er Bd der Gesamtgeschichte Schwedens. Gotha 1908. XX, 443 pp. 8vo.
Allgem. Staatengeschichte. Hrsg. von *K. Lamprecht*. Abt. 1: Werk 8. (Bd 1—3. *Geijer, E. G.*, Geschichte Schwedens. 1832—36. Bd 4—6. *Carlson F. F.*, Geschichte Schwedens. 1855—87.)

WITTMANN, P., Kurzer Abriss der schwedischen Geschichte. Breslau 1896. VI, 96 pp. 8vo.

HEIDENSTAM, V. von, Die Schweden und ihre Häuptlinge. Ein Buch für Junge und Alte. Übers. von *P. Klaiber*. Th. [1-] 2. München 1909—11. 8vo.

KIRCHHOFF, Seemacht in der Ostsee. Bd [1-] 2. Kiel 1907—08. 8vo.
1. 17. und 18. Jahrhundert. Mit 4 Kart. u. 18 Plänen. 2. 19. Jahrhundert. Nebst einem Anhang über die Vorgeschichte der Ostsee. Mit 6 Kart. u. 10 Plänen.

THOMSEN, V., The Relations between Ancient Russia and Scandinavia and the Origin of the Russian state. Three lectures 1876. Oxford & London 1877. VI, 150 pp. 8vo.

ARNE, T. J., La Suède et l'Orient. Études archéologiques sur les relations de la Suède et de l'Orient pendant l'âge des vikings. Upsal 1914. 243 pp., 1 map 8vo.
Archives d'études orientales, publ. par *J. A. Lundell.* Vol. 8.

JOHNSON, A., The Swedish Settlements on the Delaware, their history 1638—1664 with an account of the South, the New Sweden and the American Companies. Vol. 1—2. New York 1911. 8vo.

EDÉN, N., Sweden for Peace. The Programme of Sweden in the Union Crisis. Upsala, Stockholm, London 1905. 40 pp. 8vo.

— La Suède veut la paix. Le programme de la Suède dans la crise scandinave. Upsala, Stockholm, Paris 1905. 37 pp. 8vo.

— Schwedens Friedensprogramm und die skandinavische Krise. Upsala, Stockholm, Halle a. Saale 1905. 46 pp. 8vo.

NORDLUND, K. The Swedish-Norwegian Union Crisis. A history with documents. Upsala, Stockholm, London 1905. 107 pp. 8vo.

— La crise suède-norvégienne. Historique et documents. Upsala, Stockholm, Paris 1905. 94 pp. 8vo.

— Die schwedisch-norwegische Krise in ihrer Entwickelung aktenmässig dargestellt. Upsala, Stockholm, Halle a. Saale 1905. VI, 115 pp. 8vo.

STEVENI, W. B., The Scandinavian Question. With a map. London 1905. 152 pp. 8vo.

JORDAN, L., La séparation de la Suède et de la Norvège. [Thèse.] Paris 1906. 165 pp. 8vo.

MOHN, A., La Suède et la révolution norvégienne. Une page d'histoire de la civilisation. Paris & Genève [1906]. 150 pp. 8vo.

See also sections concerning Sweden in universal histories such as The Cambridge Modern History. 1—13, atlas. Cambridge 1902—12; Histoire générale du 4e siècle à nos jours. Publ. sous la direction de *E. Lavisse* et *A. Rambaud.* 1—12. Paris [1893—] 1901; Weltgeschichte, herausg. von *I. von Pflugk-Hartung.* [1—6.] Berlin 1908—10.

Demography besides Language. Dictionaries.

SUNDBÄRG, G., Bevölkerungsstatistik Schwedens 1750—1900. Einige Hauptresultate. Stockholm 1907. 170 pp. 8vo.
14. internationaler Kongress für Hygiene und Demographie. Berlin, Sept. 1907.

FAHLBECK, Der Adel Schwedens (und Finlands). Eine demographische Studie. Jena 1903. VIII, 361 pp. 8vo.

NOREEN, A., Geschichte der nordischen Sprachen besonders in altnordischer Zeit. 3. vollst. umgearb. Aufl. Strassburg 1913. VII, 239 pp. 8vo.
Grundriss d. german. Philologie hrsg. von *Hermann Paul.* 3:e Aufl. Bd 4.

WENSTRÖM, O., & LINDGREN, J., Engelsk-svensk ordbok. [A English-Swedish Dictionary.] 2:a stereotyp. uppl. Stockholm 1905. 1758 + 50 pp. 8vo.

WENSTRÖM, O. & HARLOCK, W., Svensk-engelsk ordbok. Skolupplaga. — A Swedish-English Dictionary. Stereot. uppl., 3:e tryckn. Stockholm 1912. VI, 880 pp. 8vo.

SCHULTHESS, P. F., Fransk-svensk ordbok. [Vocabulaire français-suédois.] Skoluppl. Stereot. uppl., 3:e tryckn. Stockholm 1906. XXXIII, 740 pp. 8vo.

— Svensk-fransk ordbok. [Vocabulaire suédois-français.] 2:a stereot. uppl. Stockholm 1900. 1737 + 43 pp. 8vo.

HOPPE, O., Tysk-svensk ordbok. [Deutsch-schwedisches Wörterbuch.] 3:e stereot. uppl., 3:e tryckn. Stockholm 1910. VI, 796 pp. 8vo.

AUERBACH, C., Svensk-tysk ordbok. [Schwedisch-deutsches Wörterbuch.] Stereot. uppl. Stockholm 1907—. 8vo.

LERCHE, F., Rysk-svensk ordbok. [Russko-švedskij slovarʹ.] Hälsingfors 1896. III, 954 pp. 8vo.

MANDELSTAM, J., & IGELSTRÖM, A., Svensk-rysk ordbok. Enligt uppdrag av kejserliga senaten för Finland utarb. Švedsko-russkij slovarʹ. Hälsingfors 1905. III, 1106 pp. 4to.

National Characteristics including Customs and Manner of Living.

HEIDENSTAM, O. G. VON, Swedish Life in Town and Country. London [1904]. VIII, 205 pp., 24 pl. 8vo.

LLOYD, L., Peasant Life in Sweden. Illustr. London 1870. X, 479 pp., 8 pl. 8vo.

BELLESSORT, A., La Suède. Paris 1911. VII, 412 pp. 8vo.

BERNARDINI-SJÖSTEDT, L., Pages suédoises. Essais sur la psychologie d'un peuple et d'une terre. Paris 1908. 436 pp., 15 pl. 8vo.

COUSSANGE, J. DE [Pseud.], La Scandinavie. Le nationalisme scandinave. Paris 1914. 344 pp. 8vo.

GANDOLPHE, M., La vie et l'art des Scandinaves. Avec une lettre de *Gaston Paris*. Paris 1899. VIII, 308 pp. 8vo.

NIEMANN, W., Das Nordlandbuch. Eine Einführung in die gesamte nordische Natur und Kultur. Berlin 1909. XVI, 251 pp., 63 pl. 8vo.

TOLSTOJ, L. L., Sovremennaja Švecija v pišmach-očerkach i illjustracijach. Moskva 1900. VI, 290 pp. 8vo.

TURI, J., Das Buch des Lappen Johan Turi. Erzählung von dem Leben der Lappen. Herausg. von *E. Demant*. Frankfurt am Main 1912. XX, 262 pp., 2 pl. 8vo.

Constitution and Administration.

Constitution.

Lois fondamentales de Suède et de Norvège suivies de l'acte d'union entre les deux royaumes. Traduction. Stockholm 1867. 162 pp. 8vo.

Recueil des traités, conventions et autres actes diplomatiques de la Suède entièrement ou partiellement en vigueur le 1 janvier 1910. Publ. par *Carl Sandgren*. [Avec Suppl.] 1910 et 1911. Stockholm 1910—13. XX, 1038 + V, 278 pp. 8vo.

BERENCREUTZ, F. A. G., Précis du droit constitutionnel du royaume de Suède précédé d'un aperçu général du pays et de la population. Stockholm 1886. 90 pp. 8vo.

FAHLBECK, P., La constitution suédoise et le parlementarisme moderne. Paris 1905. VIII, 349 pp. 8vo.

— Die Regierungsform Schwedens. Berlin 1911. XXIX, 319 pp. 8vo.

ASCHEHOUG, T. H., Das Staatsrecht der vereinigten Königreiche Schweden und Norwegen. Freiburg i. B. 1886. XII, 208 pp. 8vo.
Handbuch des öffentlichen Rechts der Gegenwart in Monographien. Bd 4: Halbbd 2: Abth. 2.

DYMŠA, L., Gosudarstvennoe pravo Švecij. T. 1. S.-Peterburg 1901. XV, 404 pp. 8vo.
1. Časť istoričeskaja.

PILLONS, R., L'union scandinave. Critique historique et politique, suivie du texte de l'acte de l'union. Avant-propos de *A. Leroy-Beaulieu*. Paris 1899. 118 pp. 8vo.

EDÉN, N., Die schwedisch-norwegische Union und der Kieler Friede. Eine historisch-staatsrechtliche Untersuchung. Autor. deutsche Ausg. Mit einer Vorbemerkung von *F. Arnheim*. Leipzig 1895. XII, 155 pp. 8vo.

State Administration, including Official Statistics, State Finances, Consular Office, Prison System.

Sveriges officiella statistik [Statistique officielle de la Suède. Avec des résumés — l'Annuaire aussi les en-têtes — en français]. Stockholm [1851-] 1910—. In fol. & 8vo.

(As to the different series, see the special article on Official Statistics, p. I, 219 in this Work.

Arbetsstatistik utg. av K. Kommerskollegii avdelning för arbetsstatistik [Statistique du travail de l'Administration du Commerce]. Stockholm 1899—1913. 8vo.

NB. Les séries suivantes avec des tables des matières et des résumés en français. A: 5. Le contrat collectif en Suède. 1—3. 1910—11. A: 10. La durée du travail dans l'industrie et dans les métiers manuels. 1911. B. Caisses de secours mutuels en cas de maladie enregistrées. Operations en [1901-] 1910. [1905-] 1912. C. Accidents du travail en [1906-] 1909. [1908-] 1913. D. Prix des denrées ménagères et des loyers [1904-07-] 1908-09. [1909-] 1912. E. Grèves survenues en [1903-07-] 1910. [1909-] 1911. F. Les contrats collectifs conclus en [1908-] 1910. [1911-] 1912. H. Le chômage en Suède [1908-09-] 1910. [1910-] 1911. L. Les conditions des ouvriers de l'agriculture 1910. 1911. L'Intervention des conciliateurs officiels [1907-08-] 1911. [1910-] 1912.

(This publication is continued as Socialstatistik, ed by the Royal Social Board and forming part of Sveriges officiella statistik, see p. I, 223 foll.)

Annuaire statistique de la Suède. Publ. par le Bureau central de statistique. Statistisk årsbok. Année 1 (1914). Stockholm 1914. 8vo.

WICKSELL, K., Finanztheoretische Untersuchungen nebst Darstellung und Kritik des Steuerwesens Schwedens. Jena 1896. XIV, 352 pp. 8vo.

BERENDTS, E., Gosudarstvennoe chozjajstvo Švecii. Čast' 1. S.-Peterburg 1890. IX, 861 pp. 8vo.

1. Istorija gosudarstvennago chozjajstva Švecii do 1809 g.

Sweden. Customs ordinance of june 9, 1911. (In force from 1st December, 1911) Brussels 1912. 6th ed. 120 pp. 8vo.

Bulletin international des douanes. 1911—12. Nr. 93.

Suède. Ordonnance douanière du 9 juin 1911. (En vigueur à partir du 1 décembre 1911). Bruxelles 1912. 6 éd. 115 pp. 8vo.

Bulletin international des douanes. 1911—12. Fasc. 93.

Schweden. Zolltarif vom 9. Juni 1911. (Seit dem 1. December 1911 in Kraft). + Nachtrag 1—3. Brüssel 1912—13. 6. Ausg. 119 pp. 8vo.

Bulletin international des douanes. Jahrg. 1911—12. H. 93.

Zoll- und handelsrechtliche Bestimmungen des Auslandes. Herausg. im Reichsamt des Innern. Heft 5. Schweden. Berlin 1909. IV, 150 pp. 8vo.

Consular Statute Book of Sweden. Stockholm 1910. 296 pp. 8vo.

Royal Ordinance concerning the Consular Service of Sweden given at the palace of Stockholm september 24, 1906 and general instructions for the performance of the consular office. Stockholm 1909. 388 pp. 8vo.

Ordonnance royale concernant le service consulaire suédois donnée au château de Stockholm, le 24 septembre 1906 et instruction générale relative au service consulaire. Stockholm 1910. 390 pp. 8vo.

Konsularische Gesetzsammlung Schwedens. Stockholm 1910. III, 301 pp. 8vo.

Königl. Verordnung betreffend das Konsularwesen Schwedens gegeben Stockholm im Schloss den 24 September 1906, und allgemeine Instruktion für die Amtsausübung der Konsuln. Stockholm 1910. 392 pp. 8vo.

WIESELGREN, P. S., Le système pénitentiaire suédois, son développement et ses progrès. 2:e éd. Stockholm 1900. 88 pp., 6 pl. 8vo.

— Die Entwickelung des Gefängniswesens in Schweden. Übersicht. Stockholm 1900. 93 pp., 6 pl. 8vo.

Municipal Administration of Stockholm.

Statistique de la ville de Stockholm [En-têtes et résumés en suédois et en français]. Sér. 1—14. Stockholm 1868—. 4to.

1. Annuaire statistique de la ville de Stockholm. 1868—. 2. Administration municipale. 1868—. 3. Hygiène. 1869, 70, 78—. 4. Assistance publique. 1872—. 5. Constructions et habitations. 1868—. 6. Bulletin mensuel de statistique. 1906—. 7. Bulletin hebdomadaire de la statistique sanitaire. 1876—. 8. Service d'incendie et d'ambulance. 1876—. 9. Placement 1905,06—. 10. Enquêtes spéciales: Budgets de ménage 1907—08; Journée normale de travail aux bureaux municipaux 1906; Chômage 1909, 1910; Retraite des vieillards 1910; Calcul des frais de l'Assistance publique 1912; Habitations à bon marché 1912; Brännkyrka 1914. 11. Commerce et navigation. 1901—. 12. Fabriques et métiers. 1901—. 13. Nettoyage ainsi que résumé statistique du mouvement. 1909—. 14. Elections. Résumé ststatistique. 1910—.

Law.

Les codes suédois de 1734 (civil, pénal, commercial) suivis des lois postérieures promulguées juqu'à ce jour. Trad. du suédois, annotés et précédés d'une introduction par *Raoul de La Grasserie*. Paris 1895. CLV, 527 pp. 8vo.

Collection de codes étrangers. 11.

The Maritime Law of Sweden of $^{12}/_{6}$ 1891. Stockholm 1893. 173, 2 pp. 8vo.

Suède. Code maritime du 12 Juin 1891. Stockholm 1892. 142, 2 pp. 8vo.

BEAUCHET, L., Étude sur les sources du droit suédois jusqu'au XV siècle. [1—2]. Nouvelle revue historique de droit français et étranger. 14 (1890): pp. 720—786; 15 (1891): pp. 217—277.

LEHR, E., Éléments de droit civil scandinave (Danemark, Norvège, Suède). Avec la collaboration de *E. Eschelsson*. Paris 1901. XV, 416 pp. 8vo.

SYNNESTVEDT, M., Le droit international privé de la Scandinavie. Paris 1904. XIV, 331 pp. 8vo.

AMIRA, K. v., Nordgermanisches Obligationenrecht. Bd 1. Leipzig 1882. XIII, 778 pp. 8vo.

1. Altschwedisches Obligationenrecht.

ÅSTRÖM, A., Über das Wasserrecht in Nord- und Mittel-Europa. Eine systematische Darstellung vom Gesichtspunkte des schwedischen Grundeigentumsrechts. Leipzig 1905. V, 310 pp. 8vo.

See also international codes such as The Commercial Laws of the World (Die Handelsgesetze des Erdballs). London [1906]—; The Patent Laws of all Nations (Die Patentgesetze aller Völker). Berlin [1905]—.

Religion and Church.

HERRMANN, P., Nordische Mythologie in gemeinverständlicher Darstellung. Leipzig 1903. XII, 634 pp. 8vo.

RYDBERG, V., Teutonic Mythology. Author. transl. from the Swedish by *Rasmus B. Anderson*. London 1889. XII, 706 pp. 8vo.

WORDSWORTH, J., BISHOP OF SALISBURY, The National Church of Sweden. London & Milwaukee. 1911. XIX, 459 pp. 8vo.

The Hale Lectures. 1910.

WILLIAMS, G. M., The Church of Sweden and the Anglican Communion. Milwaukee & London 1910. 113 + 4 pp. 8vo.

Repr. from: The Living Church. 1910.

Suppl.: Swedish Ordination Forms before 1571.

ANJOU, L. A., The History of the Reformation in Sweden. Transl. from the Swedish by *H. M. Mason*. New York 1859. X, 668 pp. 8vo.

MARTIN, J., Gustave Vasa et la réforme en Suède. Essai historique. Paris 1906. XXX, 512, IV pp. 8vo.

FLAVIGNY, C. DE, Sainte Brigitte de Suède, sa vie, ses révélations et son œuvre. 3 éd., rev. et augm. Paris & Poitiers 1910. XIII, 775, 2 pp., 1 pl. 8vo.

HYDE, J., A Bibliography of the Works of Emanuel Swedenborg, original and translated. London 1906. XVI, 742 pp. 4to.
Appendix 4: Biographies of Swedenborg.

Education and Mental Culture.

Education. Sloyd.

ERDBERG, R. V., Das freie Volksbildungswesen in Schweden. Eindrücke und Anregungen von der dritten Informationsreise der Zentralstelle für Volkswohlfahrt. Berlin 1910. 84 pp. 8vo.
Zentralstelle für Volkswohlfahrt.

SALOMON, O., The Theory of Educational Sloyd. Author. ed. of the lectures of O—S—. Rev. and ed. by an inspector of schools. 2nd end. London n. d. XI, 150 pp., 1 pl. 8vo.

— The Teacher's Hand-Book of slöjd as practised and tought at Nääs, containing explanations and details of each exercise. Transl. and adapted for English teachers by *M. R. Walker* and *William Nelson*. 2nd ed., rev. and enlarged. London 1894. IX, 270 pp. 8vo.

SALOMON, O., Institution d'August Abrahamson: Nääs. Description faite à l'occasion de l'Exposition universelle à Paris 1900. Göteborg 1900. 32 pp. 8vo.

JOHANSSON, A., Nääser Modellserien. Methodische Anweisungen zur Ausführung der Modelle für Lehrer und zum Selbstgebrauch zusammengestellt. Übertr. von *A. Heidengren*. Stockholm 1895. 71 pp. 8vo.

Swedish Gymnastics.

POSSE, N., The Swedish System of Educational Gymnastics. Boston 1890. 275 pp. 8vo.

LEFEBURE, L'éducation physique en Suède. Nouv. éd. Bruxelles, Paris 1908. XXII, 284 pp., 8 pl. 8vo.

TÖRNGREN, L. M., Lehrbuch der schwedischen Gymnastik. Autor. Übers. von *G. A. Schairer*. 2. verb. Aufl. Esslingen a. N. 1914. XII, 579 pp. 8vo.

Sport.

Schweden. Internationale Sportausstellung, Berlin 1907. Stockholm 1907. 105 pp. 4to.

The fifth Olympiad. The official report of Olympic games of Stockholm 1912. Issued by the Swedish Olympic Committee, ed. by E. Bergvall. Transl. by Edw. Adams-Ray. Stockholm 1913. XXXI, 1117 pp., 305 pl. 8vo.

5 Olympiaden av *C. Cederström*, *G. Drake*, *E. Fick*. Red. *S. Hermelin*, *Erik Peterson*. 5 Olympiad. Olympic Games Stockholm 1912. Transl. into English by *T. Husen*. 5. Olympiade. Olympische Spiele Stockholm 1912 Deutsch von *G. Sterzel*. 5 Olympiade. Jeux olympiques Stockholm 1912. Trad. par *S. Harel*. Göteborg 1912. 525 pp. 4to.

The Olympic Games Stockholm 1912. Ed. by *J. E. Sullivan*. New York 1912. 249 pp. 8vo.
Spalding's »Red cover»series of athletic handbooks. N:o 17 R.

DIEM, C., Die Olympischen Spiele 1912. 2:e Aufl. Neukölln 1912. 204 pp. 8vo.

Public Collections and Institutions for Science and Art.

Das Nordische Museum in Stockholm. Stimmen aus der Fremde. Als Beilage: Führer durch die Sammlungen des Museums. Stockholm 1888. 122 pp. 8vo.

Les Prix Nobel 1901—. Stockholm 1904—. 8vo.

FRIED, A., Die Nobelstiftung. Ihre Einrichtungen und ihre Bestimmungen. Leipzig 1906. 32 pp. 8vo.
Sozialer Fortschritt. N:r 69—70.

See also descriptive catalogues — in English, French, or German — of the respective public collections and institutions.

History of Literature.

HORN, W., History of the Literature of the Scandinavian North from the most ancient times to the present. Transl. by *R. Anderson*. With a bibliography of the important books in the English language relating to the Scandinavian countries, prepared by *T. Solberg*. Chicago 1884. IX, 507 pp. 8vo.

— Geschichte der Literatur des Skandinavischen Nordens von den ältesten Zeiten bis auf die Gegenwart. Leipzig [1879,] 1880. VIII, 404 pp. 8vo.

BERNARDINI-SJÖSTEDT, L., La littérature scandinave. Paris 1894. 282 pp. 8vo.
Bellman, Tegnér, V. Rydberg, Snoilsky, Strindberg.

CRUPPI, L., Femmes écrivains d'aujourd'hui. 1. Suède. Paris [1912]. 487 pp. 8vo.

SCHWEITZER, Ph., Geschichte der skandinavischen Litteratur von ihren Anfängen bis auf die neueste Zeit. Th. 1—3. Leipzig [1886—89]. 8vo.
Geschichte der Weltlitt. in Einzeldarstellungen. 8: 1—3.
1. Geschichte der altskandinavischen Litteratur von den ältesten Zeiten bis zur Reformation. 2. Geschichte der skand. Litt. von der Reformation bis auf die skandinavische Renaissance. 3. Geschichte der skand. Litt. im 19. Jahrh.

NIEDNER, F., Carl Michael Bellman, der schwedische Anakreon. Mit Bildnis. Berlin 1905. VIII, 398 pp. 8vo.

BRANDES, G., Moderne Geister. Literarische Bildnisse aus dem 19. Jahrhundert. 2:e Aufl. Frankfurt a. M 1887. 8vo.
S. 285—368. Esaias Tegnér.

LIND AF HAGEBY, L., August Strindberg, the Spirit of Revolt. Studies and Impressions. London 1913. 370 pp., 16 pl. 8vo.

ESSWEIN, H., August Strindberg im Lichte seines Lebens und seiner Werke. 3. Aufl. München & Leipzig 1909. 212 pp., 28 pl. 8vo.

LEVERTIN, O., Selma Lagerlöf. Berechtigte Übers. von *Francis Maro*. Berlin 1904. 79 pp., 16 pl. 8vo.
Die Literatur. Sammlung illustr. Einzeldarstellungen. Hrsg. von *Georg Brandes*. Bd 7.

The Fine Arts.

ROOSVAL, J., Die Kirchen Gotlands. Ein Beitrag zur mittelalterlichen Kunstgeschichte Schwedens. Stockholm 1911. 231 pp., 142 pl. 8vo.

UPMARK, G., Die Architektur der Renaissance in Schweden 1530—1760. 100 Tafeln mit Text. Dresden [1897—1900]. VIII, 132 pp., 100 pl. Fol.

Auswahl von schwedischer Architektur der Gegenwart. Von schwedischen Architekten hrsg. zur internationalen Architekturausstellung in Wien 1908. Stockholm 1908. V, 95 pp. 8vo.

LESPINASSE, P., L'art français et la Suède de 1637 á 1816. Essais de contribution à l'histoire de l'influence française (1 sér: 1 p.). Paris 1913. 248 pp. 8vo.
Coll. de la Soc. de l'histoire de l'art français.

Peasant Art in Sweden, Lapland and Iceland ed. by *Charles Holme*. London 1910. In-4:o.
The Studio. Autumn number 1910.

LEMBERGER, E., Die Bildnis-Miniatur in Skandinavien. 1. Schweden. Berlin 1912. 108 pp., 100 pl. Fol.

GRANBERG, O., Inventaire général des trésors d'art, peintures et sculptures, principalement de maîtres étrangers (non scandinaves) en Suède. T. 1—3. Stockholm 1911—13. 4to.

LARSSON, CARL, Das Haus in der Sonne. [Übers. von *E. Jungbeck-Grönland*]. Mit 16 Aquarell-Reproduktionen & 50 Abb. Düsseldorf & Leipzig 1909. 74 pp. 4to.

DELTEIL, L., Anders Zorn. Paris 1909. 4to.
Delteil, L., Le peintre-graveur illustré. T. 4.

SERVAES, F. T. H., Anders Zorn. Mit 93 Abb. und 12 Buntbl. Bielefeld & Leipzig 1910. 103 pp., 12 pl. 8vo.
Künstler-Monographien hrsg. von *H. Knackfuss*. 102.

Music.

NIEMANN, W., Die Musik Skandinaviens. Ein Führer durch die Volks- und Kunstmusik von Dänemark, Norwegen, Schweden und Finnland bis zur Gegenwart. Mit 6 Portraits. Leipzig 1906. XI, 155 pp. 8vo.

SOUBIES, A., Histoire de la musique. États Scandinaves. 19 siècle. Danemark et Suède. Paris 1901. 80 pp. 8vo.

HOLLAND, H. S., & ROCKSTRO, W. S., Memoir of Madame Jenny Lind-Goldschmidt, her early art-life and dramatic career 1820—1851. Vol. 1—2. London 1891. 8vo.

Science.

SWEDENBORG, E., Opera quædam aut inedita aut obsoleta de rebus naturalibus. Nunc edita sub auspiciis Regiæ Academiæ Scientiarum Suecicæ. 1—3. Holmiæ [Stockholm] 1907—11. 8vo.
1. Geologica et epistolæ. Præfatus est *G. Retzius*, introductionem adjunxit *A. G. Nathorst*, ed. *A. H. Stroh*. 1907. 2. Cosmologica. Introductionem adjunxit *S. Arrhenius*. 1908. 3. Miscellanea de rebus naturalibus. 1911.

CARL VON LINNÉS Bedeutung als Naturforscher und Arzt. Schilderungen herausg. von der Königl. schwedischen Akademie der Wissenschaften anlässlich der 200-jährigen Wiederkehr des Geburtstages Linné's. Jena 1909. 8vo.

BERZELIUS, J. J., Selbstbiographische Aufzeichnungen. Herausg. von *H. G. Söderbaum*. Nach der wörtlichen Übers. von *E. Wöhler* bearb. von *G. W. A. Kahlbaum*. Leipzig 1903. XIV, 120 pp. 8vo.
Monographien aus der Chemie herausg. von *G. W. A. Kahlbaum*. H. 7.

Social Movements,

including Labour Questions, Women's Rights, Temperance Movement, etc.

ALBRECHT, H., Bodenpolitik und Wohnungsfürsorge in Schweden. Berlin 1910. 72 pp. 8vo.
Zentralstelle für Volkswohlfahrt, von der 3. Informationsreise der Zentralstelle. *Aus:* Konkordia.

Les lock-out et la grève générale en Suède en 1909. Rapport présenté par l'Office du travail à l'Administration Royale de l'Industrie et du Commerce. Stockholm 1912. 186 pp. 8vo.

Die Aussperrungen und der Gross-streik in Schweden 1909. Bericht der Abteilung für Arbeitsstatistik des königl. Kommerzkollegiums. Stockholm 1912. 206 pp. 8vo.

National Council of Women of Sweden. Quinquennial report June 1904—june 1909. Report june 1909—june 1911. Stockholm 1909, 1911. 32+28 pp. 8vo.

WIKMARK, E., Die Frauenfrage. Eine ökonomisch-soziologische Untersuchung unter spezieller Berücksichtigung des schwedischen Bürgertums. Halle a. S. 1905. VIII, 203 pp. 8vo.

MANNSTRÖM, C. O., Bilder und Blätter aus der Geschichte der schwedischen Nüchternheitsbewegung. Im Auftrage der Schwedischen Gesellschaft für Nüchternheit und Volkserziehung. Berlin 1913. XII, 224 pp., 1 pl. 8vo.

RUBENSON, S., Das Gothenburger System und seine Anwendung in Stockholm nebst geschichtlicher Übersicht über die Branntweinsgesetzgebung in Schweden. Übers. von *E. A. Meyer*. Stockholm 1907. XIV, 281 pp. 8vo.

WIESELGREN, P. S., A Contribution to the History of the Development of the Gothenburg System. Stockholm 1907. 110 pp. 8vo.

— Zur Entwicklungsgeschichte des Gothenburger Systems. Stockholm 1907. 119 pp. 8vo.

HIRSCH, A. M., Swedish Poor Laws and Charities. A Publication dedicated to the International Congress, Copenhagen 1910 by the Swedish Poor Law Reform Association (Svenska fattigvårdsförbundet). Stockholm 1910. 56 pp. 8vo.

RAPMUND, O., & HERRMANN, Das öffentliche Gesundheitswesen in Schweden. Sonder-Abdr. a. d. Vierteljahrsschr. für gerichtl. Med. u. öffentl. Sanitätswesen. Berlin. 3 Folge: 37 (1908), Suppl.-H., S. 46—118.

The Struggle against Tuberculosis in Sweden 1908. [A Publication ded. to the International Tuberculosis Congress in Washington]. Ed. by *Sture Carlsson*. Stockholm 1908. 200 pp. 8vo.

Bulletin de la Ligue nationale suédoise contre la tuberculose. *Réd.: Sture Carlsson.* N:o spécial [1—4]. Stockholm 1906—12. 8vo.

1905. La lutte contre la tuberculose en Suède. Ouvrage publié aux frais du Gouvernement Suédois, réd. par *S. E. Henschen*. Upsala 1905. 282 pp. 12 pl. 4to.

Ouvrage dédié au Congrès international de la tuberculose à Paris 1905.

Schweden. An die XI internationale Tuberkulosekonferenz. Berlin 1913, von Svenska nationalföreningen mot tuberkulos. Hrsg.: *Sture Carlsson*. Stockholm 1913. 124 pp. 4to.

Industries.

A General Survey.

KEY, H., La vie économique de la Suède. Paris 1913. 166 pp. 8vo.

Wegweiser durch die Wirtschaftsverhältnisse von Schweden. Berlin 1914. 46 pp. 8vo.

Volkswirtschaftliche Reiseführer, hrsg. vom Handelsvertragsverein. Bd 6.

FRAHNE, C., Das Wirtschaftsleben Schwedens. Ein Überblick auf statistische Grundlage unter besondere Berücksichtigung der deutsch-schwedischen Wirtschaftsbeziehungen. [Diss.] Berlin 1914. 166 pp., 1 map. 8vo.

Die Wasserkräfte Schwedens und deren Ausnutzung. Berarb. in der Königl. Wasserfalldirektion, Stockholm. Stockholm 1910. 68 pp., 1 pl. 4to.
Kungl. Vattenfallsstyrelsen. Meddelanden. N:r 2.

Agriculture and Cattle-Breeding.

FLACH, W., JUHLIN-DANNFELT, H., & SUNDBÄRG, G., Sveriges jordbruk vid 1900-talets början. Statistiskt kartverk. L'agriculture en Suède au commencement du 20ème siècle. Göteborg 1909. 262 pp., 89 maps. Fol.
(Index en français. Vocabulaire français.)

JUHLIN-DANNFELT, H., Aperçu sur les institutions agricoles de la Suède, à la demande du comité exécutif de l'Académie Royale d'Agriculture. Stockholm 1910. 78 pp. 8vo.

FEILITZEN, Hj. von, Der schwedische Moorkulturverein und seine Tätigkeit. Jönköping 1904. 38 pp., 6 pl. 8vo.

PUDOR, H., Das landwirtschaftliche Genossenschaftswesen im Auslande. Bd 1. Das landwirtschaftliche Genossenschaftswesen in den skandinavischen Ländern. Leipzig 1904. VIII, 153 pp. 8vo.

Führer der wissenschaftlichen Excursionen der 2. Agrogeologenkonferenz herausg. unter Mitwirkung von *Gunnar Andersson, Hj. von Feilitzen, H. Hesselman, Alb. Vesterberg.* Mit 4 Kart. Stockholm 1910. 176 pp. 8vo.
2. Internationale Agrogeologenkonferenz. Stockholm 1910.
Inhalt: Verbreitung, Ursprung, Eigenschaften und Anwendung der mittelschwedischen Böden.

RICHARDSEN, A., Die schwedische Rinderzucht. Berlin 1910. VI, 150 pp., IX Taf. 8vo.

LUNDBLAD, N., L'industrie laitière en Suède. Stockholm 1911. 44 pp. 8vo.
5:e Congrès International de Laiterie, Stockholm 1911.

Mining Industry and Metal Production.

The Iron Ore Resources of the World. An inquiry made upon the initiative of the 11 International Geological Congress, Stockholm 1910. Vol. 1—2, atlas. Stockholm 1910. 4to & fol.

NICOU, P., Étude sur les minerais de fer scandinaves. Laponie suédoise. Grängesberg. Gisements de minerais pauvres. Paris 1911. 286 pp., 6 pl. 8vo.
Annales des mines 1911: livr. Février, Mars & Avril.

JOHANSSON, H., Die eisenerzführende Formation in der Gegend von Grängesberg. Stockholm 1910. IV, 172 pp., 8 pl. 8vo.
Geol. fören. i Stockholm förhandl. Bd 32: H. 2.

DAHLERUS, C. G., Exposé de l'industrie minière et metallurgique de la Suède. Publié aux frais du »Järnkontoret». Stockholm 1905. 157 pp., 2 maps 4to.

Stora Kopparbergs Bergslags aktiebolag. Mines and Works in Sweden. Stockholm 1907. 12 pp., 23 pl. 8vo.

Manufacturing Industries.

Sveriges fabrikskalender. Schwedische Fabrikanten-Adressbuch—Directory of Swedish Manufacturers—Catalogue des manufactures de la Suède—Annuario delle industrie svedese—Catalogo de las industrias svecas-Ruotsin tehdaskalenteri—Švedskij fabričnyj kalendar'. 2:a ed. 1910—1911. Stockholm 1910. 552 pp. 8vo.

Schwedisches Industriebuch, herausg. zum Baltischen Ingenieur-Kongress, Malmö 1914. Göteborg 1914. 312 pp. 4to.

ASKERGREN, Th. A., Handbok för nordisk trävaruindustri. The Timber Trade's Handbook for Sweden, Norway, Finland and Russia. Stockholm 1913. XII, 782 pp. 8vo.

Paper and Pulp-makers Directory of Sweden, Norway, Denmark, Finland. Ed. *H. Brusewitz.* 2nd English ed. Göteborg 1913. 242 pp., 1 map 8vo.

Wästerås. Allmänna svenska elektriska aktiebolaget. General Electric Mfg C:o of Sweden, Westerås 1883—1908. Göteborg 1909. 165 pp. 4to.

Aktiebolaget Separator.—Separator Company Ltd. 1883—1908. Transl. Stockholm 1908. 66 pp. 4to.

Aktiebolaget Separator. 25 années de la Société anonyme des écrémeuses Separator. 1883—1908. Trad. Stockholm 1908. 73 pp. 4to.

Aktiebolaget Separator 1883—1908. Deutsche Textübers. Stockholm 1908. 78 pp. 4to.

Svenska Aktiebolaget Gasaccumulator. Beschreibung über das AGA-System. Stockholm 1914. 80 pp. 8vo.

CHURCH, W. C., The life of John Ericsson. Vol. 1—2. London 1890. 8vo.

HENNING, R., Alfred Nobel, der Erfinder des Dynamits und Gründer der Nobelstiftung. Eine biographische Skizze. Mit 12 Abb. Stuttgart [1912]. 51 pp. 4to.

Commerce, including Shipping.

London, Swedish Chamber of Commerce. Year book. 1907—. London 1908—. 8vo.

— Svenska handelskammaren. Journal publ. monthly. *C. A. Löwenadler, L. Zettersten.* Anglo-Swedish trade journal. Vol. 1 (Nov. 1908-Dec. 1909)—. London. 8vo.

New York, Swedish Chamber of Commerce. Annual Report 1907—. New York. 8vo.

— Bulletin. Vol. 1 (1907)—. New York. 4to.

Sydney, Swedish Chamber of Commerce for Australasia and South Sea Islands. Annual Report for the year 1913. Sydney 1914. 8vo.

— Bulletin. Vol. 1 (1914). Sydney. 8vo.

Sveriges handelskalender. Schwedischer Handels- und Industriekatalog. Swedish Business Directory. Annuaire du commerce et de l'industrie de la Suède. Årg. 36. 1915. Stockholm 1914. 4to.

Svensk industri- och exportkalender utg. af *John Hammar.* [Swedish Trade Index publ. by the General Export Association of Sweden. — Schwedischer Industrie- und Exportkatalog. — Annuaire de l'industrie et de l'exportation de Suède. — Anuario de la industria y exportacion de Suecia. — Švedskij eksportnyj i promyšlennyj kalendaŕ.] 5 uppl. 1915—1916. Stockholm 1915. 735 pp., 8 pl. 8vo.

FAHLBECK, P. E., Die Handelspolitik Schwedens und Norwegens [in den letzten Jahrzehnten]. [Leipzig 1892]. 8vo.
Schriften des Vereins für Socialpolitik. 49: S. 303—360.

SÖDERBERG, G., Die Handelsbeziehungen zwischen Schweden und Deutschland. Inaug.-Diss. Leipzig 1906. 180 pp. 8vo.

HOLLENBACH, F. M., Schweden, seine wirtschaftliche Entwickelung und sein Handel mit Deutschland. Berlin 1910. 62 pp. 8vo.
Komité zur Vorbereitung des deutsch-schwedischen Handelsvertrags.

HITCHCOCK, F. H., Our Trade with Scandinavia 1890—1900. Washington 1901. 124 pp. 8vo.
U. S. Department of Agriculture. Section of foreign markets. Bulletin N:o 22.

CHEMINAIS, G., L'exposition de Stockholm en 1897. Études et impressions sur l'industrie et le commerce de la Suède. Les rapports commerciaux avec la France. Paris [1898]. 188 pp. 8vo.

Skandinavisk sjöfartskalender 1906—1907. Scandinavian Shipping Directory and Handbook. Tillæg: Nord-Tyskland. Dock and port charges. Red. og Udg. *H. P. Grönlund-Jeppesen.* Köbenhavn [1906]. 362 pp. 8vo.

Code List containing the names etc. of Swedish ships to which signal letters of the commercial code of signals have been allotted. [1867—]1906. Stockholm [1867—]1906. 8vo.

Sveriges skeppslista. Utg. af Kungl. Kommerskollegii fartygsregistreringsafdelning. [List of Swedish Vessels]. [1837—]1914. Stockholm [1837—] 1914. 8vo.
(Swedish and English text).

Credit Establishments.

FLUX, A. W., The Swedish Banking System. Washington 1910. 248 pp., 1 map 8vo.
National Monetary Commission. Senate documents. Vol. 30. 1910.

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(I = First Part; II = Second Part).

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Errata.

Page I, 10, line 22 from the top. Instead of: Loussavara, read: *Luossavara.*
Page I, 61, map. Instead of: Forest Map, read: *Forest Map (according to* K. Bohlin).
Page I, 378, line 10 from the bottom. Instead of: Pehrsson-Bendtz, read: *Pehrsson-Bendz.*
Page I, 431, line 20 from the bottom. Instead of: Dr J. Arwedson's Institute, read: *Dr J. Arvedson's Institute.*
Page I, 447, line 12 from the top. Instead of: John Ericson's, read: *John Ericsson's.*
Page I, 468, line 7 from the top. Instead of: Arnoldsson, read: *Arnoldson.*
Page I, 469, line 5 and foll. from the bottom. Instead of: Forsgren, read: *Forsgrén.*
Page I, 506, illustration. Instead of: substructure, read: *in course of erection.*
Page I, 552, line 6 from the bottom. Instead of: H. Forsell, read: *H. Forssell.*
Page I, 589, line 14 and 15 from the top. Instead of: A. F. Regnell (1807—1908) read: *A. F. Regnell (1807—84).*
Page I, 612, line 26 from the top. Instead of: E. Fredholm, read: *E. I. Fredholm.*
Page I, 626, line 8 from the bottom. Instead of: G. Nordenskjöld, read: *G. Nordenskiöld.*
Page I, 760, line 1 from the bottom. Instead of: Sunnerdal Foundation, read: *Sunnerdahl Foundation.*
Page II, 31, illustration. Instead of: Westmanland, read: *Västmanland.*
Page II, 337, line 7 from the bottom. Instead of: J. G. Swarts' kvarnverk, read: *J. G. Swartz' kvarnverk.*
Page II, 436, line 18 from the top. Instead of: gelantin, read: *gelatine.*

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